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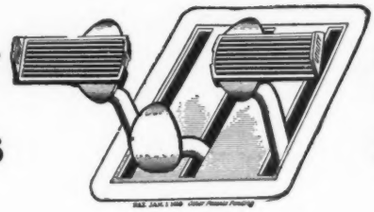

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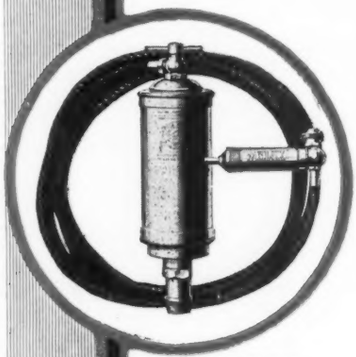

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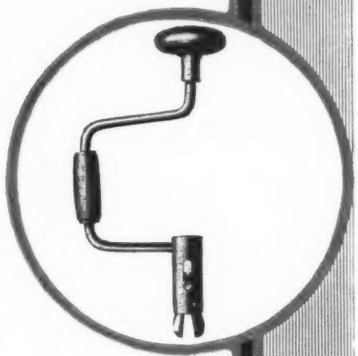

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XL NEW YORK—THURSDAY, APRIL 17, 1919—CHICAGO No. 16

Necessary Internal Co-operation

Between Employer and Employee

Must Be Mutually Evolved

Capital and Labor Are Equal Necessities in Modern Industry, Says Steinmetz, and Must Be Equally Represented in Management and Distribution of Profits

NEW YORK, April 11—Dr. Charles P. Steinmetz of the General Electric Co. expressed his views on the present chaos in the labor situation and the strife between capital and labor before the editors of New York business papers to-day by declaring that the necessary internal co-operation between the organizations and the workers will never come about until both parties mutually evolve the scheme. It will not do for the scheme to be evolved by the organization and thrust upon the workers, because then it will be viewed with more or less suspicion by the workers, and will be considered paternalistic to a greater or less extent.

Many organizations have advanced schemes for closer co-operation with their workers, but these have not been favorably accepted by the workers solely because they originated with the organization and the worker had nothing to do with the formulation of them. In all such cases the worker does not accept such suggestions favorably even if they might work for his good.

Internal co-operation that will be effective must come from the workers as well as the organization, and if a corporation has in mind evolving an improved scheme it is necessary for the workers to be given equal representation in the formulating and evolution of the plan. Such a plan, evolved under such conditions, will undoubtedly succeed if its fundamentals are correct, whereas such a plan evolved solely by the organization and thrust upon the workers would, in nine cases out of ten, not succeed.

Dr. Steinmetz believes that the organization must make greater sacrifices, make much greater expenditures of money and go immeasurably farther than it has gone up to this time in co-operation of labor in order to solve the present labor chaos. He advanced many reasons for this: Generally speaking, the organization heads are much better educated than the workers and so should be expected to take a broader view of the case. Many of the organization are college graduates, whereas too many of the workers have had to leave school at 14 and have had no opportunity of completing their education. It is really natural to expect that those who have had to neglect their education cannot take as broad a view of the situation as those who have had the opportunity of going through college. Because of this, the organization must take a broader view than it is inclined to take, and must view with greater clearness the radicalism, or, perhaps, unbusinesslike view, expressed by many of the workers.

The results leading up to the present division between capital and labor or between organizations and workers are historical, according to Dr. Steinmetz. It started when industry began growing and the factory owner could not keep in touch with his individual workers as he did at one time. This led to the appointment of superintendents, foremen, etc., whose acts ostracized workers to quite an extent. The employer got out of touch with his workers; he drifted away from them, his mind was engrossed in the development of business and the progress of the worker was neglected.

Inauguration of Labor Unions

This led to the creation of labor unions which were started for offensive purposes and literally became a hostile camp to the organization. It has taken a generation or more to bring about this condition of hostilities and it is not going to be corrected in a day, a week, a month or a year. And bringing about the desired internal co-operation is going to be a long slow process, in which the organization or employer must take the lead.

Dr. Steinmetz outlined the various systems that have been used by organizations to obtain closer co-operation, but dismissed most of them as being unsatisfactory, and advocated a plan in which capital and labor would have equal representation in each other—would be one group instead of two groups, namely, labor and capital. In his plan, labor would be equivalent to capital. The worker would have labor stock and the organization would have capital stock. Both organization and labor would share in the profits, getting dividends, one on capital stock and the other on labor stock. Both would share in the management; both capital and labor would be entitled to a fair rate of interest, capital on the money invested and labor on the wages for work done. All profits beyond this belong to capital and labor, and should be divided as dividends, part on the capital stock and part on the labor stock.

Dr. Steinmetz's address complete follows:

There is an old saying, "In unity lies strength and a house divided against itself must fall." If that is true of anything, it is true in Mother Industry, and particularly true to-day where modern civilization in the world's war has practically become bankrupt, and we now, as receivers, have to reorganize the world again. Our industries must have co-operation to be successful, efficient; to be able to take care of the world's work as it has to be done to redeem our civilization from what has occurred in the last few years. But is it possible?

Interests of Capital and Labor

The socialistic radical labor agitator tells us there can be no peace between capital and labor. They are inherently antagonistic and must fight to a finish because the interests of one are against the interests of the other. In industrial depression the employer as well as employed suffer. The old-time corporation president preaches to us that capital and labor interests are identical; that if the individual interests are trusted to his keeping that they will be taken care of. At the same time every child sees and knows that a dollar more paid out in wages means a dollar less profit and that the interests of capital and labor are different—entirely opposite in some respects. We cannot get any further in solving the problem if we take an extreme view one way or the other. Capital and labor interests are not identical but are the same in some respects and opposite in other respects. In general, in any industry, those interests which have to do with industry on the outside, customers, etc., are usually identical.

How to Institute Co-operation

Within the industry the interests of employer and employee are often opposite to each other. There are relations in which capital and labor interests are identical and some in which they are not identical, but there are many other relations in our modern civilization where there are common interests and unidentical interests. Take buyer and seller, manufacturer and customer, landowner and renter. Many interests in common, and still we do not have warfare. They are not going to fight merely because there are some features where the interests are opposite. In all those relations where the relations exist as between employer and employee, there is no settlement of the condition by fight and warfare; but on the contrary there are often, usually very often, friendly relations between the manufacturer and customer. It is not the historical relation, as we unfortunately find, in this one feature. Why is it necessary that employer and employees and capital and labor cannot get along in the same manner by co-operation? The reason is historical. Originally the employer and employee bore an equal standing as regarding industrial power in the days of small manufacture. The organization of employers as represented by the formation of industrial corporations meant an increased power on the side of the employer and a disadvantage to the employed, until labor organizations were formed; but conditions had already become hostile.

How to bring the co-operation about; how to return to such conditions as should have remained operative, is the main problem, because we must bring about co-operation within our industry if we wish to meet the demands of the new world.

It has taken two generations of development to bring about the present unfortunate situation where differences are settled by fighting. We cannot expect to secure this co-operation by merely wishing or talking about it. It is a long, slow, difficult work which will mean many setbacks, and we have to remain at it and fight for it.

Employer Expected to Have Broader View

Adjustment must come first from the employers, but not from any moral reason. The present situation is not the fault of labor more than capital. It is merely historical development of a situation beyond the control of man. The employer must have a broader view than the employees. We must not forget that there are still many imperfections in our civilization. Most serious is that a large majority of men cannot enjoy complete education, as would be desirable for making the most of themselves, and heads of industry as a rule have the benefit of the broader education and must take the broader view of things. We cannot expect the same broad view of the one who left school at fourteen years of age as the one who has enjoyed a more extensive education. That the initiative must come from capital is realized. All through groups of occupations and industries we have talk on co-operation. We must realize it does not mean to spend a few dollars here and there, but the work is probably the most important development in the industrial field which faces us to-day, and men must devote their time and attention to it and must give high-grade service the same as those in charge of other administrations. We cannot expect to see any positive results until we are really willing to approach it more seriously in time, interest, quality of men and amounts of money devoted to bringing about industrial co-operation.

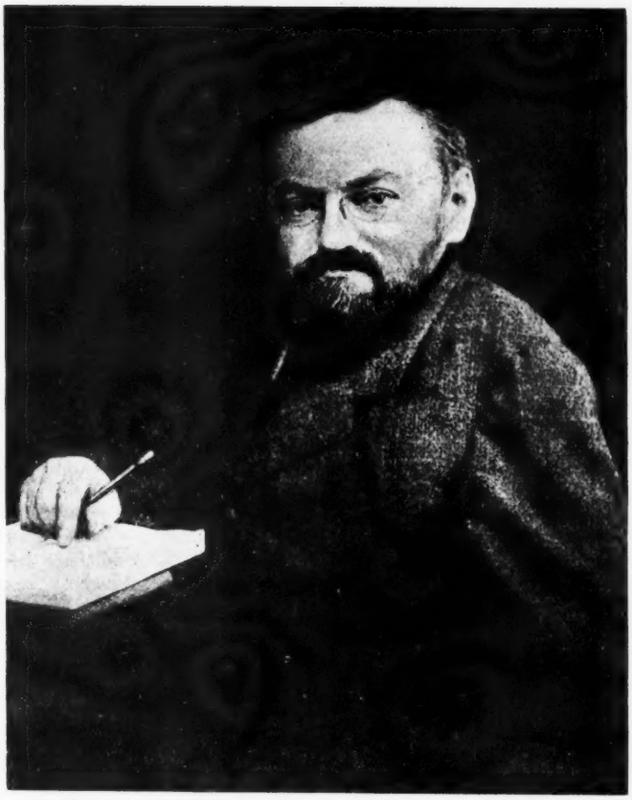
Co-operation implies two parties working together, not one settling the matter and telling the other you must do that and that and then we will co-operate. Unfortunately, most of the serious efforts made in this direction have been of that character—that the employer has worked out plans and then asked the employees to co-operate on those plans. Very often those plans are good and the whole scheme would have been satisfactory if it could have been worked out jointly, but it came as paternalism and was therefore tainted from the beginning. That is not co-operation.

It is easy to say we must have co-operation; also to find fault. It is not easy to make suggestions how it should be done and how the present strained relations between capital and labor should be overcome. Probably there is no single way to bring about true co-operation. It depends largely on local conditions and social conditions. In short, there is not a broad and single way. Before we try to find out let us discover the relation of Mother Industry. One attitude, the attitude of the old-time employer, which means industry is private property of the one who supplies the capital. That is the old-time relation where industry is private property of the owner, which recognizes only capital and not labor. This relation was destroyed forever at the moment when President Roosevelt interfered in the anthracite coal trouble and brought both sides to terms. The other extreme is the socialistic conception that all wealth is created by labor and that all wealth therefore belongs to labor and that capital is a parasite on labor due to having acquired a monopoly of the means of production. At present industrial production requires capital and labor. Both are necessary. Labor unrest is a demand for a share of the profits of industry and a share in the management of industry. This is the final foundation of all our social unrest. Since they are both necessary it is right that they both demand a right in the share of the profits and management of industry. There are several ways—mostly unsuccessful. One way, welfare work, which is important and useful but offensive and insulting, by being forced on labor in a paternalistic manner. It is appreciated where not done as a welfare work but merely as a matter of corporate self interest. We must realize quality of one's work depends on conditions under which work is done. That makes the difference in the self-respect and quality of the man. This will not bring about co-operation. We must not use the name welfare work. It should be called an Industrial Relation Department or Committee, instead of Welfare Department. The most difficult thing in co-operation is to put yourself in the other's place and see things as he sees them.

Another attempt which has been made is the attempt of getting closer relation by the bonus system, giving bonuses during times of industrial prosperity and getting the employee interested in the industry. To some extent that is all right. Somewhat of paternalism. It may be all right in Germany, where people have been trained to look up to their masters as superiors, but leaves a bad taste among Americans. They are prone to ask, "Why not give us an increase of wages instead of a bonus?" The bonus system has the disadvantage of sharing only in profit, not in management.

Another attempt is the committee system, claimed to have been successful in England. There are several forms. There are the committees elected by employees which take up with employers all relations of mutual importance and interest, arbitrating wages, hours, etc. Another form is joint committee, half of which is elected by employees and half by the corporation. This appears to have very much in its favor. There are, however, some difficulties. The most serious difficulty is that labor has its own organization, and such action is apt to be taken by labor unions as not recognizing them. Labor unions claim that they represent the employees. Facts show in many cases that they are right, because while union men may often have a minority among employees, when serious questions arise, experience very often shows that the majority of non-union workers take the lead of the union rather than the non-union committees. Shop committees are liable to be considered as eliminating the labor unions by putting up a rival union. While leaders of industry recognize the necessity of co-operation, unions of labor organizations have not yet realized the advisability of co-operation in industry. But there is another side. Do we want the committee system? Let us assume it is successful. A board of directors on one side and a labor committee or committees on the other. Is this not another warfare by organizing two different parties? The last is wage dividend. Mother Industry requires capital and labor. Therefore both are entitled to share in the profits. Capital is entitled to a fair rate of interest on the money invested and labor is entitled to a fair rate of wages for the work done. All profits beyond that belong to capital and labor. These should be divided as dividends, being dividends on capital stock, the other being divided on labor stock as found by yearly wages. This system is in operation in a number of corporations, in electric utilities companies and others. It lacks provision for share in the management. But we could carry it further and recognize labor as equivalent to capital and give the labor stockholder the same right as the capital stockholder in the management. This would be revolutionary, but both would share in the profits, getting dividends, one on capital and the other by labor stock. Both share in the management (labor union officials could hold the proxies). This does not set up rival administration, but brings about joint control by evolution and not by revolution. The question is: How far should employees be recognized as stockholders? Should every one, even if he joined yesterday, vote to-day? There are many things that show that only those who have been with the organization for a number of years should be recognized as wage stockholders, taking part in dividends and management. We could set the limit at ten years. There would not be many and would not make any radical change in industry, and every year or so we could change the minimum, going down to six or five years. This would eliminate any opposition except from the extreme socialists who refuse to recognize capital at all.

Finally, leave only laboring men as stockholders. This revolution could be brought about by evolution if desired. This could be carried to full socialization of society by evolution, as the final outcome of our industrial development.



DR. CHARLES PROTEUS STEINMETZ was born in Silesia and educated in Berlin and Zurich. He came to America more than 30 years ago and is at present chief consulting engineer for the General Electric Co., Schenectady. When Steinmetz reached America he had just $10 in his pocket. He is physically handicapped as very few men are, and yet has risen by sheer force of will and intellect to a commanding position as a worker and a thinker. He has written many books on various subjects and is considered by many to be the greatest electrical engineering genius in the world.

Gear Makers Hold Successful Meeting

Company Representation in American Gear Manufacturers' Association Doubled Within a Year—Progress Made in Standardization Work—Technical Papers Read and Discussed

By P. M. Heldt

WORK on its standardization program and the reading of technical papers filled most of the 3 days' session of the American Gear Manufacturers' Convention held at the Hotel Statler in Cleveland on April 14, 15 and 16. The Association is a rapidly growing one, as is shown by the fact that while at the time of the meeting at White Sulphur Springs, W. Va., last year there were only 32 member companies, the number had increased to 59 at the time this meeting was called, and several more were added in the course of the meeting. As President Sinram expressed it in his inaugural address, most of the manufacturers of cut gears are now represented in the Association.

The present meeting brought the Association to the close of its second year. In his inaugural address President Sinram said that the third year of the Association's activities opened with our country and business confronted with many large problems, and that few would question the statement that the future would demand radical changes in many directions. In the evolution already under way, co-operation would light the way to many of the problems arising. The character and extent of this co-operation would measure the influence of the American Gear Manufacturers' Association and would have a distinct bearing on the stability of the industry.

President Sinram's Address

Mr. Sinram quoted Otto Kahn, the eminent New York banker, who, in a recent address before the Cleveland Chamber of Commerce, stated that the United States was facing the greatest era of prosperity in its history, and, farther, that this country would stand fast no matter what happened in Europe. Nearly a year ago, at the White Sulphur Springs meeting, in speaking of the Gear Makers' Association, he had made the statement that "The foundation had been completed and was substantial." Notwithstanding the unprecedented demands upon industry during the interval, the American Gear Manufacturers' Association had made progress.

Membership in the A. G. M. A. had become a valuable asset to the gear manufacturer. The second year of the Association closed with over 60 interests privileged to use its monogram, these being represented by more than 120 leaders of the art. Few were the representative manufacturers of cut gear who were not affiliated with the A. G. M. A. This membership evidenced a desire and willingness to co-operate, and an appreciation of the value of the exchange of ideas on subjects of common interest.

Referring to the subject of standardization, Mr. Sinram said the evolution of gear standards was an obligation the gear makers owed not only to themselves, but to the collective gear purchasers and the enginering world. While gear standardization in the aggregate was a task of considerable magnitude, a start with the simpler phases would form the foundation on which they might build successfully. Definite and specific standards would be recommended for the consideration of the Association in the near future.

Demands of the war and other conditions had restricted progress during a part of the year just closing. However, a most successful meeting solely in the interests of standardization was held in Buffalo in February. Another meeting was held at Buffalo on March 27 by the Commercial Standardization Committee, and as a result definite and specific recommendations would be submitted for consideration to the Association.

Some consideration had been given to the formation of a division or bureau to adjust controversies as to product between manufacturer and purchaser—a plan to insure equitable settlement without litigation. Times and conditions considered, the A. G. M. A. was to be congratulated on its progress and the present state of the organization. A successful industrial organization had been developed under most abnormal conditions and was now available for service. To be of greatest benefit to the membership now demanded activity in practically every phase of Association endeavor, and the success of the A. G. M. A. was the responsibility of every representative.

Standards Committee Meeting

After the official welcome to Cleveland by a representative of Mayor Davis and the reading of President Sinram's inaugural address, the meeting was turned over to Chairman F. B. Waterman of the Standards Committee. The entire afternoon of the first day was devoted to reports of various subcommittees of the Standards Committee and discussions thereon. Reports were made by the following sub-committees: Spur Gear, Bevel and Spiral Bevel Gearing, Worm, Worm and Spiral Gears, Herringbone Gears, Sprockets, Composite Gearing, Gears and Pinions for Electric Railways and Mine Locomotives, Hardening and Heat Treating, Inspection.

None of the work of the sub-committees was in such shape that final action could be taken on it, and the recommendations definitely adopted as standards at this meeting of the Association. Hence it is not considered advisable to go into the details of the reports and discussions.

The greatest progress had been made by the Commercial Standardization Committee, which had worked out a blank contract form which it is expected the Association will definitely adopt immediately.

This will form the basis of any contract entered into for the manufacture of cut gears by members of the Association, and covers all the points that come up in doing such work.

Technical Session

What may be described as a technical session of the meeting took place Tuesday forenoon, when three papers on subjects of interest to gear makers were read. The first paper on "Gear Steels," was by Dr. J. Heber Parker of the Carpenter Steel Company. We expect to reprint this paper in full in an early issue of AUTOMOTIVE INDUSTRIES. Mr. Parker said that cut gears might be conveniently divided into three classes, namely, gears for automotive, electric car and commercial or jobbing use, respectively. They might also be divided into two classes according to the grade of steel used and the kind of heat treatment given it, into case hardened and tempered gears.

The question had often been asked as to which of these two classes was the better, but the only answer that could be given was that each was best adapted to a particular class of work. Tempered steel gears were best for clash gears, while case-hardened gears were best for constant mesh gears. With tempered gears, misalignment of shafts was sometimes a cause of pitting. This could be overcome by a change in the drawing temperature and sometimes by an increase in the length of gear face.

Dr. Parker said that there were in use six grades of steel

for automotive gears, and he gave a table showing the chemical compositions and the physical properties of these steels. It is of interest to note in this connection that the elastic limit of the core material of case-hardened gears made from these steels varies from 50,000 to 150,000 lb. per sq. in.

Discussion of Dr. Parker's Paper

This paper was followed by a lively discussion. E. J. Frost asked the speaker whether he had made any experiments to determine what percentage of phosphorus and sulphur was necessary to produce any harmful effect on the properties of steel. Dr. Parker said that the impression that phosphorus and sulphur were very detrimental constituents had been handed down from the dark ages. During the war the Standardization Committees of the Society of Automotive Engineers and the American Society for Testing Materials had let down the bars on phosphorus and sulphur to a large extent, simply because it was impossible to obtain steel in the large quantities required under the rigid specifications as to these two elements which had previously been insisted upon.

Dr. Unger of the Carnegie Steel Co. had made some tests with high sulphur steels in which the excess sulphur was added to the steel in the mold, and his results showed that an excessive sulphur content had no deleterious effect, but this method of adding the sulphur had been objected to by some of his colleagues.

Dr. Parker said that the greatest value of a low sulphur in steel was really the fact that it was a criterion of the conditions under which the steel had been produced, because sulphur could be eliminated only by means of a reducing slag, and the fact that there was a low sulphur content therefore showed that the steel had been made in a reducing atmosphere. In order to show the real effect of sulphur on the physical properties of steel, it would be necessary to run a big open-hearth heat, and that of course would be an expensive undertaking.

A question was also asked as to whether there was not a tendency toward non-uniformity in the quality of 3½ per cent nickel steel. Dr. Parker said that this steel had a tendency to laminate, and as a result showed low values in transverse tests. The addition of a moderate amount of chromium overcame this tendency.

Dr. Parker also made repeated references in his paper to the subject of shock tests and drop tests. This matter was also referred to in the discussion and it was then brought out that it was almost impossible to make a comparison of the results of such tests obtained by different observers, owing to the use of different machines and to different conditions in making the tests. The suggestion was made in this connection that the American Gear Manufacturers' Association might take it upon itself to standardize a shock test and a shock testing machine for gear material.

Value of Vanadium Steel

A question was also asked the speaker in regard to the value of vanadium steel. His answer was that his company did not believe in the use of steels containing minute quantities of vanadium, of the order of 0.08 per cent. Vanadium steels had been exploited by the sellers of ferro-vanadium. The point had been made that the vanadium steels had better machining qualities than chrome nickel, and other high-grade steels, but here they ran up against the difficulty that there was no recognized test for machinability. Steels containing an appreciable vanadium content were of very high quality, but with vanadium climbing rapidly back to its old price of $10 per lb. the outlook for the popularization of these steels was rather discouraging.

Dr. Parker was also asked regarding the respective merits of the scleroscope and the Brinell machine for testing hardness. He said that one advantage of the scleroscope over the Brinell was that it could be used on any finished surface without destroying that surface. A scleroscope no doubt could be used very well for inspection purposes. That is, after it had once been decided that a material should show a certain scleroscope hardness, the instrument was well adapted for quickly determining whether or not the parts were up to this degree of hardness. But where it was decided to make comparative tests the Brinell instrument was preferable, at least up to about 400 points.

Reference was also made in the paper to air-hardening chrome nickel steels, and in answer to a question the speaker said that these were introduced by Derihon of Belgium, and only a small amount found its way to this country previous to the war. This steel contained 0.30 per cent of carbon, 1.5 per cent of chromium and 4 per cent of nickel, and its most valuable characteristic was that it hardened in the air without practically any distortion.

The usual plan was to place the parts on an iron plate which was inserted into the furnace and heated up to a moderately high temperature, after which the plate was withdrawn and the parts allowed to cool in the air. A scleroscope hardness of 70 is about the limit obtainable with this steel. Unfortunately this steel is very hard to machine, and another difficulty is that it must be annealed within very narrow temperature limits. Where it is essential to have a hard surface without distortion this steel has its uses. During the war it was employed for the connecting rods of aircraft engines.

In order to obviate difficulty from distortion, some people in manufacturing case-hardened gears first rough them out, carbonize and quench them. Then the gears are annealed, finish-cut and rehardened.

Worms and Worm Wheels

The next paper on the program was one on "Worms and Worm Wheels," by G. W. Carlson of the Timken-Detroit Axle Co. and was of an elementatry character. Mr. Carlson brought out the fact that in the early years worm gearing was used chiefly to effect a very large reduction in speed; this necessitated very short leads and resulted in a low efficiency of transmission. People had formed an idea that whereas in spur and bevel gears the motion was very largely of a rolling character and there was only a slight amount of sliding motion, in worm gearing the motion was almost entirely sliding.

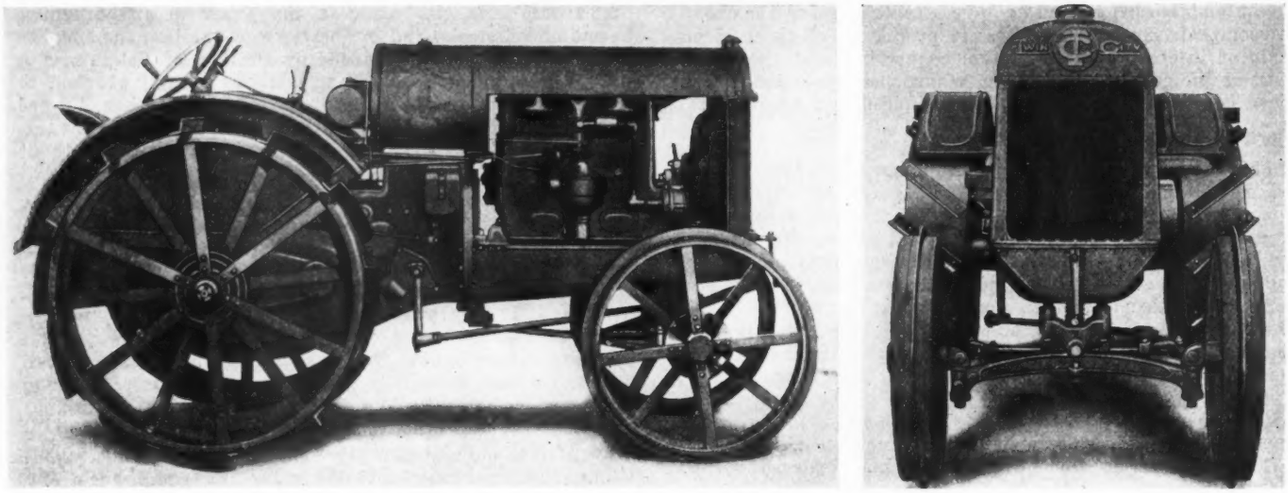
However, recent advances in the design of worm gearing had resulted in an increase of rolling and a decrease in sliding motion. Asked as to how this had been brought about, Mr. Carlson said by the adoption of a constant lead angle of 45 deg. and a pressure angle of 45 deg. taken on a line tangent to the tooth base circle of the wheel.

Mr. Carlson was asked whether the chief object in view in the selection of this large pressure angle was not to secure more space to get a grinding wheel in between the teeth, to which query he replied that the design of the gear had been perfected in England by the David Brown Co., and that he was not in position to give the reasons for the choice of pressure angle.

J. B. Foote gave some points regarding the use of worm gearing in tractor drives. He said there was a great difference in the conditions of operation of the final drive gears in motor trucks and motor tractors respectively. In plowing with a tractor the machine pulls under nearly full load sometimes for a distance of three-quarters of a mile or so without letup, and under these conditions the oil film is forced out from between the teeth, with the result that the draft is as much as 25 per cent greater when approaching the end of the field as when first beginning the furrow. Naturally, there is also a great deal of wear on the gear. Therefore, in designing a tractor worm gear the aim should be to make it large enough to prevent the forcing out of the oil film, but if this is done there will not be sufficient ground clearance. He was, therefore, of the opinion that the worm gear was not as well adapted to tractor transmission as to truck transmission.

E. J. Frost read a paper on "Proper Sizes and Materials for Gears for Tractor Construction." We expect to reprint this paper in full in an early issue of AUTOMOTIVE INDUSTRIES. The main point of Mr. Frost's argument was that by the use of high-grade alloy steels in tractor construction the necessary sizes of gears and shafts could be much reduced and thus the proper enclosure of the working parts greatly facilitated.

The entertainment features of the convention, in charge of J. C. McQuiston of Pittsburgh, were also a great success. They included a banquet at the Statler and an automobile tour through the city of Cleveland.



Side and front views of the new Twin City tractor

Twin City 12-20 Kerosene Tractor

A Three Plow Tractor with Double Intake and Exhaust Valves, Enclosed Drive, Pressure Lubrication, Thermostatic Temperature Control, Backbone Frame Construction and Front Spring Suspension

By P. M. Heldt

NONE of the new tractors put out during the past year has elicited more favorable comment than the Twin City 12-20 which was introduced to the trade at the New York and Kansas City shows. It is the product of the Minneapolis Steel & Machinery Co., and is built from designs of two well-known members of the S. A. E.: H. C. Buffington, who is responsible for the engine, and A. W. Scarratt, the company's tractor engineer. Some of the advanced features embodied in the design are removable cylinder liners, counterbalanced crankshaft, double inlet and exhaust valves in the cylinder head, thermostatic engine temperature control, completely enclosed drive, backbone frame construction and spring suspension in front. The machine is to be turned out on a quantity basis at a moderate price, and there is little doubt that it will be a strong factor in the tractor market.

The cylinder bore is 4¼ in. and the stroke 6 in. The rating of 20 hp. on the belt is very conservative, as a maximum of 35 hp. is developed on kerosene and 40 hp. on gasoline at the governed speed of 1000 r.p.m. With gasoline, a brake mean effective pressure of 93 lb. per square inch is thus obtained, and with kerosene about 82 lb. These figures are considerably above the pressures obtained from conventional tractor engines, and reflect the favorable influence of the double valves and the rational form of combustion chamber.

The cylinders, together with the upper half of the crankcase, are cast in a single block, into which are inserted the cylinder liners. These liners form the entire cylinder wall, and have a bearing or guide at both ends. At the lower end a groove is turned in the guide, which is filled with packing material, while at the upper end the liner is formed with a flange, which is fitted to a ground seat. The lower end of the liner is tapered both inside and outside, so that it can be readily inserted into the cylinder block and the pistons and their rings can be easily introduced into the cylinders from the lower end. The cylinder head is cast separately, and this permits of seating the valves directly on the metal of the head and thoroughly water-cooling both the valve seats and the valve stems.

The bottom half of the crankcase is made of sheet metal, and two dash plates containing the splash troughs are inserted into the base. The crankshaft is 2⅜ in. in diameter, and is carried in three main bearings, all supported from the upper half of the case. Balance weights are forged integral with the four short arms of the crankshaft. The connecting-rod bearings measure 2⅝ x 2⅞ in., and the dimensions of the main bearings are as follows (front to rear): 2¼ x 3 1/16 in., 2 11/16 x 2⅝ in., and 2¾ x 4 in. The camshafts also are supported in three bearings each, and are so arranged that they can be withdrawn from the forward end of the engine. The shafts are 1¼ in. in diameter, and the three bearings are of the following dimensions (front to rear): 1⅞ x 2¼ in., 1⅞ x 2¼ in., and 1¼ x 2¼ in. These camshafts run in bronze bushed bearings, and have the driving gear bolted to an integral flange at the forward end.

The valves are arranged in the head at the corners of a square, the two on one side of the engine being the inlet valves, and the other two the exhausts. They have a clear diameter of 1½ in.

It will be seen from the cross-sectional drawing of the engine that the piston, when in the topmost position, projects slightly above the cylinder liners, and the entire compression space is within the cylinder head casting. This obviates the necessity for counterboring the liner from the top end. Pistons are made of cast iron, and are of conventional design, with three ¼-in. compression rings at the top end and an oil scraper ring at the bottom end. They are 5 in. long, and it will be observed that the bearing surface is about equally divided

between the upper and lower ends. The piston pin is secured in one of the piston bosses by means of a pin screw, which is secured in position by a lock nut and a cotter pin, the latter inside the piston pin. There is nothing special to note in regard to the construction of the connecting-rod, except that the cap is held on by four bolts and that it is provided with a substantial oil splasher.

The valves are operated through the intermediary of rockers and tappet rods. These tappet rods are formed with ball ends at top and bottom, the bottom end resting in a suitable socket in the bottom of a thimble-shaped push rod, which bears directly on the cam, thus forming a mushroom type cam follower. Similarly, the top end fits in a socket formed in a headed pin set into the end of the rocker lever. The valve guides have inserted bushings, and the rocker arms are provided with set screws for the purpose of adjusting the clearance. Each pair of like valves in a cylinder is operated through a single tappet rod, but each valve is separately adjustable. The valve rockers are mounted on a hollow shaft, which can be oiled through oilers on top of the pressed-steel valve housing, so that it is not necessary to remove this housing when it is desired to oil the valve mechanism. The shaft is carried in bearing brackets bolted to the cylinder heads. Oil tubes are screwed into the tops of these bearing brackets and project through the valve cover. The valve cover is formed with an outward flange where it joins to the cylinder head, and is held in position by means of nuts on the oil tubes. There is communication between the valve chamber on top of the cylinder and the crank chamber, and the crankcase breather is located on top of the valve cover. This places the breather in a high position, where there is likely to be less dust in the air. It also tends to carry some of the oil mist from the crankcase up into the valve chamber, and thus keep all parts lubricated. Contrary to common practice, the breather does not also serve as an oil filler, a special filler being secured to the forward one of two hand hole cover plates on the right side of the crankcase.

The cylinder block is cast with two compartments on each side, through which the tappet rods pass. These are open at top and bottom, but there is no opening in the outside wall, hence the usual valve cover plates are missing. Owing to the absence of these covers, and the fact that the cylinder block is straight from top to bottom, without the usual break at the bottom of the water jacket, and merges gradually into the crankcase, the engine is of unusually clean-cut appearance.

The engine is equipped with a Holley 1¼-in. kerosene carbureter. The latter draws air through a dry-type air cleaner, and fuel is fed to it by gravity from a tank having a capacity of 23 gal. of kerosene. There is also a gasoline tank of 3 gal. capacity, gasoline being used for starting. The location of the two fuel tanks is clearly shown in the side view of the complete tractor, the main tank, which is of cylindrical section, being placed on a saddle over the forward part of the transmission, and the small tank being secured to the rear side of the large one. The main fuel tank forms the rear support of the engine hood. The Bennett air cleaner is located directly beneath the carbureter, on the right-hand side of the engine. A Pierce centrifugal governor is used, and is located close to the carbureter, acting on a separate throttle in an insert in the inlet pipe.

Ignition is by a Bosch high-tension magneto, with impulse starter. The magneto is located on the left side of the engine, toward the rear, and is driven through the pump shaft, which in turn is driven through a flexible joint from a gear meshing with the exhaust camshaft gear. The governor, which is set to control the speed of the engine at 1000 r.p.m., is completely enclosed and sealed. Provision is made for fitting a speed indicator which will show the operator whether the engine is working properly, and when it is overloaded. This is not a part of the regular equipment, but is furnished at an extra charge. S. A. E. ⅞-in. spark plugs are used, and are screwed into the cylinder head casting from the side.

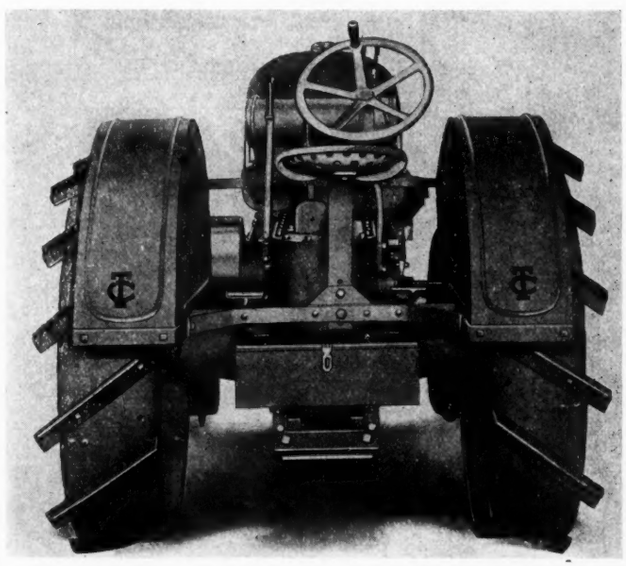
A Spirex radiator, with cast-iron top and bottom tanks and side spacers, is fitted. Water is circulated through it by means of a centrifugal pump, the outlet flange of which bolts directly against the engine casting. A 4-blade 20-in. fan is mounted on the engine, back of the radiator, and is driven through a 2-in. flat belt, the tension of the belt being maintained automatically by a coil spring pulling on the long arm of the bell crank bracket supporting the fan. The outlet from the cylinder jacket is at the forward end, and it is within this outlet fitting that the Sylphon thermostat is located. The entire cooling system has a capacity of 7 gal.

Lubrication of the crankshaft is by force feed. The gear-type oil pump is secured to the outside of the gear housing, being driven from the forward end of the pump and magneto drive shaft, and draws oil from the bottom of the crankcase through an outside pipe. It delivers oil into a main distributer pipe in the side wall of the crankcase, from which there are branches to each of the three main bearings. There is an automatic relief on the oil pump, which prevents the oil pressure exceeding a certain value. Oil holes are drilled in the crankshaft from the main to the connecting-rod bearings, and lubrication of the cylinder and piston-pin bearings is effected by both spray and splash. The large oil pockets forward on the camshaft bearings deserve notice.

The engine is mounted as a separate unit upon a front frame casting which bolts up to a bell housing on the forward end of the transmission case, thus insuring perfect alignment of the engine and transmission units. The bottom tank of the radiator forms part of the frame casting.

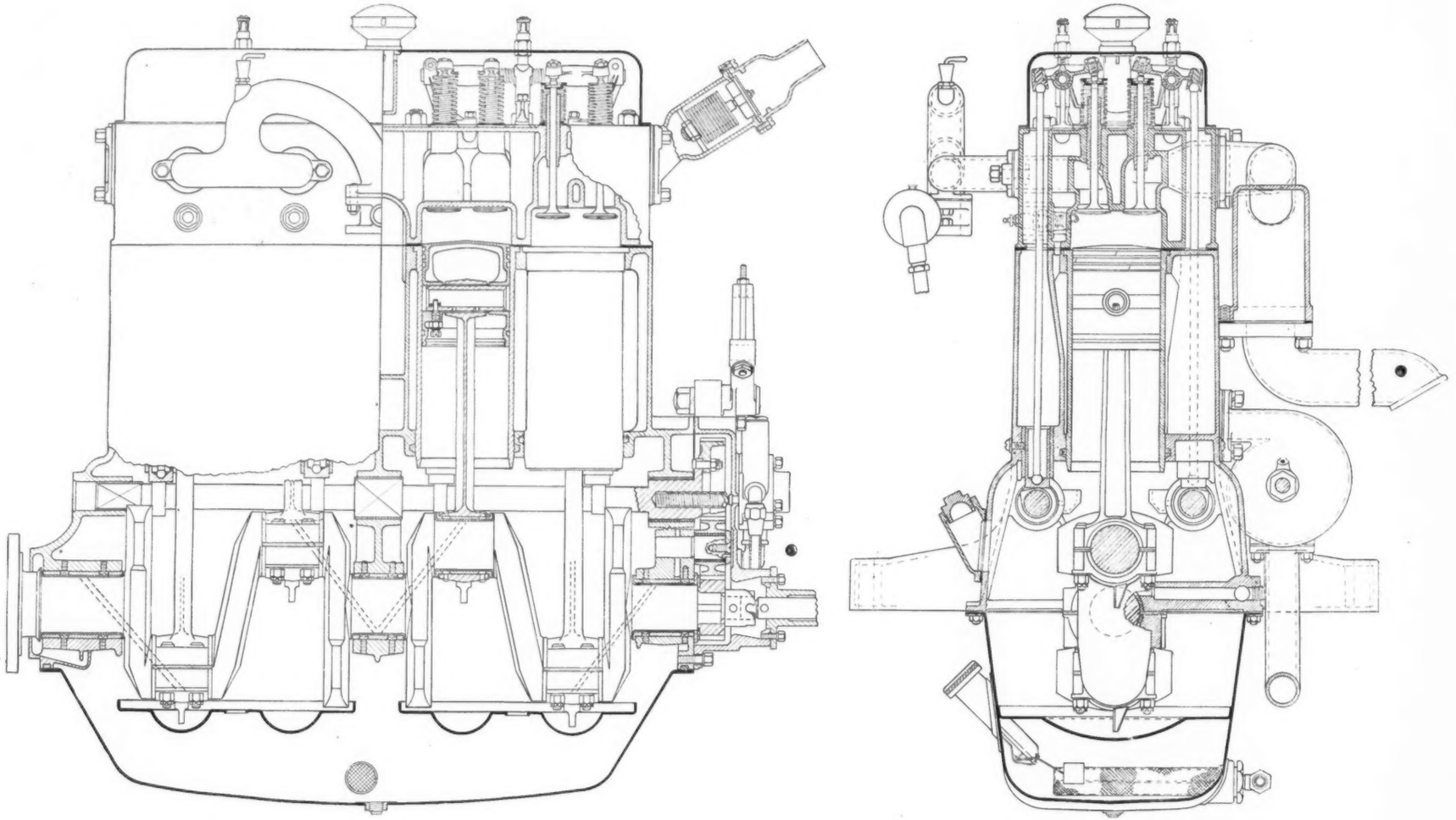
The engine power is delivered to the transmission through a Borg & Beck clutch operated by a foot lever. Access to the clutch for inspection or adjustment is provided for by a large hand hole in the bell housing.

The fuel tanks are mounted on a cast-iron saddle, which in turn forms a large cover plate over the clutch and gear-shifting mechanism.



Operator's seat and controls of the Twin City tractor

Twin City Four-Cylinder Sixteen-Valve Tractor Engine



Side and end sectional drawings of the Twin City tractor engine, which is the first tractor engine to be equipped with double intake and exhaust valves. Valves are in the cylinder head at the corners of a square, those on one side being the intakes and those at the other the exhausts

The power is delivered from the clutch shaft to the first countershaft through a pair of bevel gears. Two sliding change-speed pinions are mounted on this splined countershaft, which in turn engage either the high or low-speed intermediate gears mounted on the intermediate shaft, with the main drive pinion between them.

The main pinion engages the differential ring gear secured to the differential spider, in which four pinions are mounted. These in turn engage with the two differential bevel gears into which the splined inner ends of the rear axles are fitted. The two forward speeds are 2.2 and 2.9 m.p.h., and the reverse is 1.75 m.p.h. Gear reductions are 51:1 for the high and 68:1 for the low gear.

The differential is assembled as a complete unit, and is mounted independently on large Hyatt roller bearings located at the inner ends of the axle housings.

The transmission case and front frame castings are of semi-steel. All transmission gears, except the two large intermediate gears and the differential ring gear, are steel drop forgings, accurately machined and case-hardened to insure maximum service. The two large intermediate gears and the differential ring gear are rolled steel forgings of 0.45 carbon steel, accurately machined and heat treated. All gears are of generous proportions and are of the 20-deg. stub-tooth type.

The transmission shafts are made of 0.40 carbon steel, heat treated, and ground to exact limits, and possess great strength. They are mounted on Hyatt roller bearings throughout, and wherever thrust loads are encountered, due to bevel gears, ball thrust bearings are employed. The clutch shaft is piloted on a single annular ball bearing mounted in the flywheel. The total gear reduction for either forward speed is accomplished in three steps. The entire transmission runs continually in a bath of oil. Transmission lubrication, therefore, requires absolutely no attention on the part of the operator.

The drive wheels are 50 in. diameter and 12 in. face, with flanged rolled-steel rims and forged-steel "Tee" head spokes. The hubs are splined, and are a push fit on the rear axles. Each is secured in place by a large castle nut which clamps the wheel against a shoulder on the axle.

The drawbar, which is a steel drop forging, spring mounted, provides a liberal lateral adjustment and is attached to the rear part of the transmission case. A

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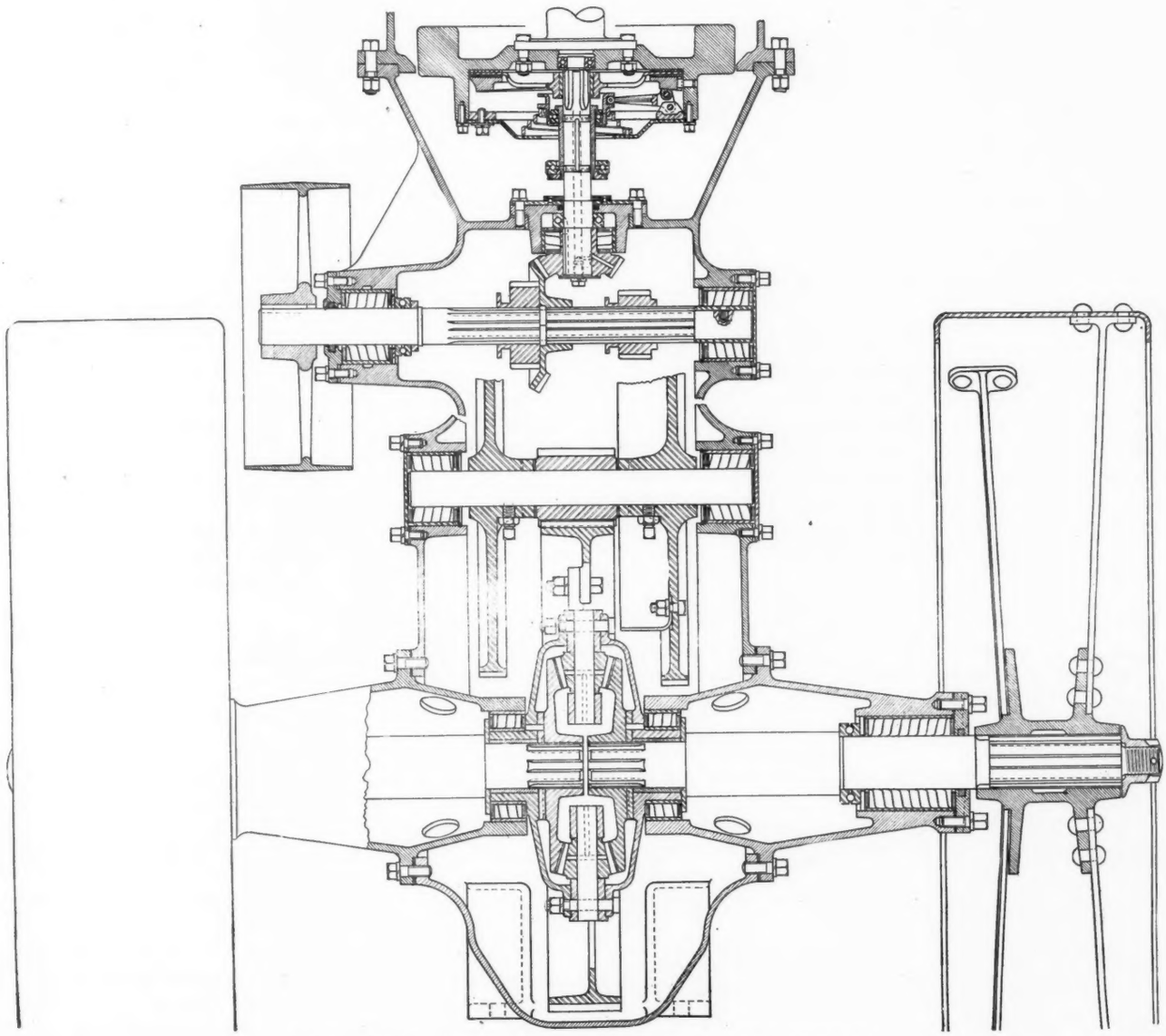


Sectional plan of Twin City tractor rear axle and transmission

Believes in Four-Cylinder Engines

Declares Smooth Operation Is Possible with Four-Cylinder Design as Well as with Greater Number of Cylinders

By Lawrence H. Pomeroy *

MY first impression of American design is the lack of attention which has been paid to the possibilities of the four-cylinder engine in its application to the first-grade automobile. One feels that, as a result of the earlier development of the four-cylinder engine in America, which tended toward large engines running at comparatively low speed, the line of recent development has been toward the multi-cylinder engine, in conjunction with a very low top-speed gear ratio. So that from the point of view of the motor, the impulses per revolution are increased in proportion to the number of cylinders, and from the point of view of the car as a whole, the revolutions of the engine are increased in accordance with the gear ratio.

The general effect is, therefore, that the tendency of design has swung heavily in the direction of obtaining even engine torque at low car speeds. It seems questionable as to whether the effect mentioned is worth the considerations involved in producing it.

Smoothness of Four-Cylinder Engine

The capacity of the senses to appreciate variations in engine torque, or, to speak more correctly, variations in engine torque reaction, is limited. For example, in using alternating current for electric lamps the eye cannot detect any variation in the intensity of the light if the periodicity of the alternating current is more than 40 cycles per second. The eye is probably the most sensitive of the human organs, and it would be a matter of considerable interest to determine the corresponding periodicity which could be detected, arising from torque variation in an automobile. In fact, the experience gained in Europe during the past 4 years is that, with the four-cylinder engine, the smoothness of running, even at quite low car speeds, is such that it is very difficult, indeed, to distinguish between a four-cylinder engine and one with six or more cylinders.

The simplicity of the four-cylinder engine from other points of view is apparent. Its chief defect—that is, the fact that severe secondary unbalanced forces are set up which produce annoying periods and vibrations—has been completely overcome by recent inventions which are worthy of a more complete description than can be given from a series of somewhat casual impressions as are here set down.

There seems to be a feeling that in order to obtain hill-climbing capacity on top gear and good acceleration, a multi-cylinder engine is essential. The determinant of the above qualities in any car depends upon the ratio of total horsepower to total weight at any given car speed. There is not the slightest difficulty in making this ratio whatever may be desired, irrespective of the number of cylinders.

For example, a well-known American car develops some 40 hp. at 1000 r.p.m., at which engine speed the car speed is about 22 m.p.h. The weight of this car is about 4400 lb. At 22 m.p.h., therefore, we have approximately 1 hp. for every 110 lb. In a four-cylinder engine which was developed in Europe before the war the horsepower developed at a car speed of 22 m.p.h. was 27 hp. for the car weight of 2500 lb.—that is, 1 hp. for every 92 lb. of weight. The capacity for acceleration and hill climbing on top speed is therefore some 12 per cent better than in the American multi-cylinder car, and there is practically no perceptible variation in torque at low speeds.

As a matter of interest, the acceleration which could be obtained on low speeds was such that if the car was suddenly accelerated upon reverse, the passenger climbing into the front seat would find himself falling out over the fenders. Even with the same ratio of horsepower to car weight, the acceleration obtainable with a four-cylinder engine is better than with the multi-cylinder, due entirely to simpler induction pipe design.

American Car Not Economical of Fuel

From the point of view of fuel economy, the American car does not strike one as approximating any degree of efficiency. A consumption of 32 to 36 ton-miles to the gallon can easily be obtained with a modern four-cylinder engine, whereas with a multi-cylinder car the consumptions seem to be more on the order of 11 miles to the gallon, or 22 ton-miles for a car of 2 tons weight.

From the point of view of oil economy, the consumption of 1 gal. for 1000 to 1200 miles is quite usual on the modern European engine.

The multi-cylinder, in general, contributes very

*Editor's Note.—L. H. Pomeroy recently arrived in the U. S. A., where he hopes to remain and establish manufacturing connections. In England he was chief engineer and executive manager of the Vauxhall company, maker of the Vauxhall car, which established such a favorable reputation for itself in the last few years. The new 30-98 four-cylinder Vauxhall is reported to be one of the best performing cars in England.

largely to the difficulty of carburetion. It is possible, in my view, to obtain very much better warming up with the four-cylinder engine, due to the fact that the induction passages are of greater area, than with the multi-cylinder engine. Further, the smallness of the individual cylinder on the multi-cylinder engine and the large area it offers to the cooling water adversely affect the point in question. The general proposition as to the number of cylinders necessary for an automobile is determined principally by the total load to be carried and the nature of the body work. For very heavy and luxurious cars there is certainly a case for the multi-cylinder engine, but the arguments therefore do not carry anything like so much weight, in my opinion, when the object of the car is to transport four or five people with adequate comfort in an open body. This leads to the probability that in future the chassis for an open touring body will be developed upon quite different lines from that for closed body work.

With respect to chassis design in general, the manufacturer of complex parts seems to have obtained such a high level in America that designers feel themselves independent of any present need for reduction in cost of manufacture by design alone.

Concluding this very brief impression, I feel called upon to express my great admiration of the methods of manufacture and the very high class of workmanship which so far I have seen. This problem has been tackled in a very whole-hearted and thorough way, and there is no doubt that the American high-grade car is deserving of the very greatest respect from European engineers.

Hilliard Clutch for Trucks and Tractors

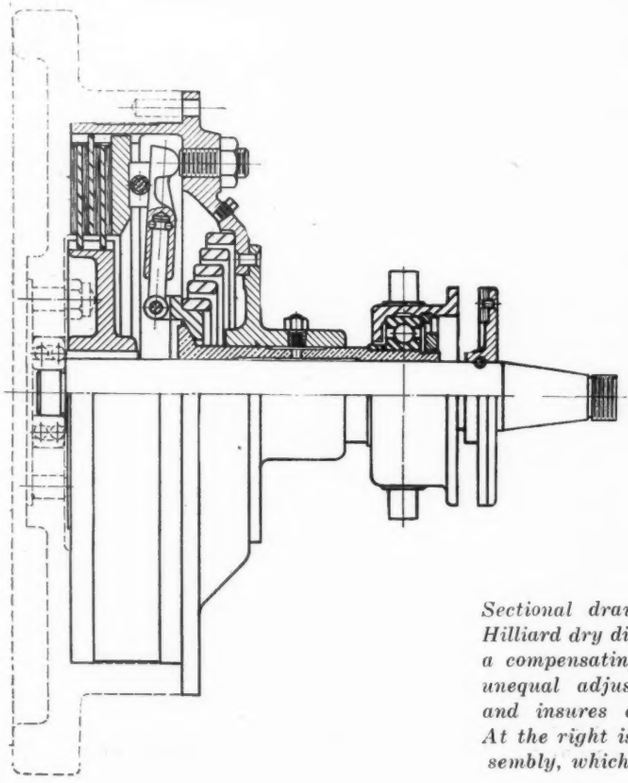
A NEW design of heavy duty clutch for use on trucks and tractors has recently been placed on the market by the Hilliard Clutch & Machinery Co., Elmira, N. Y. This firm has been manufacturing friction clutches for trucks, tractors and stationary power transmission purposes for the past 12 years. Its truck clutches in the past have been of the larger size only, having a rating of 75 hp. and over at 1000 r.p.m. To meet the demand for heavy duty type clutches for use in connection with engines of smaller ratings, the firm has now developed its types X and XU clutches.

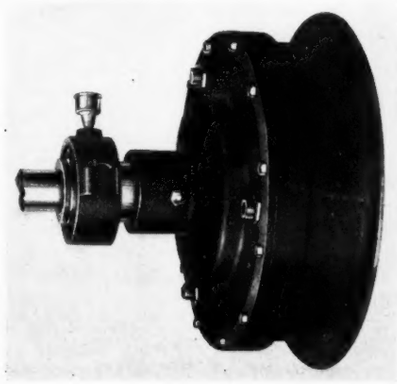
These clutches are of the dry disk type, and comprise two driven disks and one central driving disk, not counting the presser plate and the flywheel web, which also serve as friction surfaces. The friction disks are compressed by means of three levers, which are connected to a compensator ring, surrounding a sleeve on the clutch shaft. These levers bear against rollers, supported by lugs on the presser ring, and their outer end takes purchase against a set screw in the housing. These set screws serve the purpose of adjustment.

The special feature of the clutch is the compensating ring to which the lever arms are attached. This has a tapered surface which coacts with a spherical surface on a flange on the sleeve on which the shifting collar is mounted. Owing to the use of this compensating ring, if the different set screws should be unequally adjusted, or if there should be unequal wear on the disks, this will not affect the perfect operation of the clutch, as the compensator ring will so adjust itself that the pressure will be uniform over the whole surface of the disks. The clutch shaft is provided with a pilot extension, which by means of ball bearings, can be mounted inside of the flywheel. The shifter collar is provided with radially extending pins, adapted to engage with a forked lever. The rear end of the shifter collar is flanged outward, and is adapted to make contact with a disk on the clutch shaft, provided with a friction facing, which serves as a clutch brake. While the compensator ring tends to automatically equalize the pressure on the friction disks, it is nevertheless recommended to always keep the adjusting screws equally adjusted.

The matter of lubrication of the clutch has been fully attended to. A grease cup is provided for the trunnion bearings, and there is a small oil cup on the shifter sleeve. In order to insure proper lubrication of the pilot ball bearings, a small amount of oil is injected through a plugged filler opening in the housing of the clutch.

These clutches can also be operated with an oil bath, in which case from one pint to one quart of medium machine oil is poured into the housing.





Sectional drawing of the new Hilliard dry disk clutch in which a compensating ring allows for unequal adjustment and wear and insures correct operation. At the right is the complete assembly, which is fully enclosed

The Engine of the Side Car Motorcycle

An Analysis of Features of Cycle Engine Construction in a Paper Presented to the Institution of Automobile Engineers by E. Caudwell

FOLLOWING up its decision to give some attention to motorcycle engineering matters in the future, the Institution of Automobile Engineers recently has had two papers on motorcycle topics presented to it. The first of these, by D. S. Heather, contained a general critique of current motorcycle design, based on personal experience as a rider. The second, just to hand, deals with motorcycle engines from the standpoint of the designer and engineer.

The first part of Mr. Caudwell's paper is of a somewhat general character and may be briefly summarized. He points out that there are on the market to-day five varieties of engine:

(1) The single-cylinder.
(2) The Vee twin-cylinder with an angle of 55 degrees or less between the axes of the cylinders.
(3) The Vee twin-cylinder with an angle of 90 degrees between the axes of the cylinders.
(4) The horizontally opposed twin-cylinder, and
(5) Four cylinders in line.

The discussion is limited to air-cooled engines of over 31 cu. in. piston displacement. The author states that air cooling would be very difficult under right conditions but that very little attention seems to have been given to its improvement. To bear out this statement it is pointed out that a careful examination of a 1906 Minerva 3½-hp. engine cylinder and any 1919 cylinder shows no essential differences in design except that the valves and passages are somewhat larger. Better cooling, the author says, is undoubtedly badly needed, as it will give longer life of valves, less carbonization, and, in permitting the use of a higher compression ratio, will improve thermal efficiencies—and therefore fuel consumption.

As an indication of the large scope for improvement, Fig. 1 shows the tractive effort of a 4-hp. motorcycle engine. It will be noted that while it amounts to 90 lb. at 18 miles per hour, it falls away steadily until at the very moderate speed of 36 miles per hour it has dropped to 64 lb., showing that as the engine revolutions increase the mean effective pressure steadily decreases. This indicates not only inefficient cooling, but restrictions in the valve ports and passages. As a fully laden side-car outfit may weigh 700 lb., the commencing values are quite creditable, but the engine should hold its torque over a considerable range before the curve turns downward.

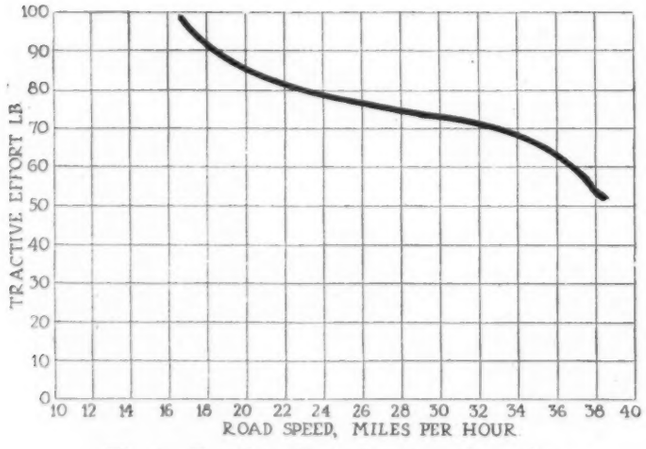


Fig. 1—Tractive effort of motorcycle engine

Next the subject of engine balance is taken up and inertia force and crank effort diagrams are given for each type. The results arrived at, with the aid of a theoretical indicator diagram, may be given most conveniently in the form of a table. All crank efforts are figured for 1700 r.p.m., and the assumed pressure diagram is such as to give 90 lb. per sq. in. mean effective pressure, and therefore about 80 lb. brake mean effective pressure.

Engine Type	Bore and Stroke, mm.	Crank Effort in Lb. In. Max. Pos.	Max. Neg.	Mean, for Entire Cycle	Ratio of Crank Effort Range to Mean
Single Cylinder Vertical.	85x99	1950	300	242	9.3
55 Deg. Vee Twin.....	85x88	1920	410	432	5.16
90 Deg. Vee Twin.....	85x88	1970	360	432	5.4
Flat Twin 74.5x68		990	300	257	5.02
Four Cylinder Vertical...	52x88	500	0	345	1.45

The values given for the variation in crank effort for these five types of engines are of course a measure of the flywheel capacity required, the single-cylinder needing the heaviest flywheels; the 90 degree Vee and the 55 degree Vee and the flat twin engines have lighter flywheels in the order given, and the 4-cylinder engine the smallest of any.

These figures have an interesting bearing on the transmission question, as the more jerkily the power is applied, the more wear and tear it causes, so that everything has to be made correspondingly heavier and stouter to withstand it, and although makers of single and twin-cylinder engines nearly all provide shock absorbers, these can hardly be regarded as a mechanical expedient. It is difficult to make a satisfactory one, although there are several types available. Some prefer a form of clutch which can be so adjusted that it only slips when the power impulse reaches its maximum value, but experience shows that this type is very difficult to regulate, as it usually either slips all the time or is locked solid.

Better results are obtained with a type which drives through a spring, but here again the springs have to be adjusted very carefully, and when they weaken through use they will simply shut up solid and give a rigid drive. In any case they are a source of waste of power, as if energy is used in slipping a clutch or shutting a spring, it is not available at the back wheel for propelling the vehicle. Such devices, therefore, can only be regarded as attempts to render an uneven drive tolerable.

Crankshaft and Flywheels

It is difficult to understand why makers of single-cylinder and Vee twin-cylinder engines, with few exceptions, have always placed the flywheels inside the crankcase; the disadvantages of this method of construction are numerous and obvious, while advantages seem to be non-existent. As the engine width has to be kept narrow, two flywheels can only be employed at the expense of bearing space. A car engine with an 85 mm. bore cylinder has a crankpin about 2 in. diameter by 2½ in. long, so that it is extraordinary that there should be many thousands of motocycle engines running with crank-

pins only ¾ in. diameter by 1¼ in. long, and still more extraordinary that, although the oil is only fed in a most erratic manner with a hand pump, they may yet last 5000 miles without requiring renewal—that is, about six months' work for a fairly hard rider. Although some improvement has been effected by the use of roller bearings, these can hardly be regarded as a satisfactory solution of the problem in view of their small size and the heavy loads and shocks to which they are subjected.

The placing of the flywheels inside the crankcase means, too, that the diameter cannot exceed about 8 in., so that they have to be unduly heavy. The average weight is from 25 to 35 lb. the pair, which is about one-third the total weight of the engine. It is also an expensive method of construction, as the crankpin and the two sides of the crankshaft are all separate pieces, which have to be fitted into the flywheels with tapers and keys, and pulled up with nuts which require to be securely locked.

In order to renew the connecting-rod big end bush, the flywheels have to be separated, and every practical rider who does his own repairs knows the difficulty of getting them to run true again, if they ever do at all.

Bearing Sizes Inadequate

Bearing sizes, too, seem quite inadequate, although these are usually of the ball or roller type. We find that one well known maker of ball bearings lists a ⅞ in. by 2 in. by ⅝ in. bearing specially for motorcycle crankshafts, and this size has been used on innumerable engines. Although it is a wonderful testimonial for the makers that these bearings may have a life of over 10,000 miles, it is short as compared with that to be obtained from the size of ball bearing that car manufacturers would employ for the same duty. If, on the other hand, a solid crankshaft is used in conjunction with an outside flywheel, the bearing surfaces can be brought up to more adequate dimensions, and the flywheel weight reduced by increasing its diameter. In this respect the flat twin engines at present on the market present a very much more satisfactory design.

However, the first four types of engines we are dealing with are all cramped for bearing space, as their width must be kept down to that which will go comfortably between a rider's feet, while the four-cylinder engine, with its axis coincident with the longitudinal axis of the machine, is practically unrestricted.

Fig. 2 shows a section of the crank, piston, and connecting-rod of a 90 mm. by 130 mm. touring car engine, and of an 85 mm. by 88 mm. motorcycle engine. Both are drawn to the same scale; as the differences are so obvious, comment is unnecessary.

Piston and Connecting-Rod

The question of the design of the connecting-rod is rather tied up with that of the crankshaft, as, with internal flywheels, the usual type having a plain gunmetal bush or roller bearing big end is obviously the best, but if a solid crank is employed, it permits of adequate bearing surfaces and a car type of rod with a split big end and white metal bearings, although even in this case ball or roller bearings may be used, as they can be arranged to thread on over the crank webs.

The restrictions connected with the use of internal flywheels limit the distance between them to about ⅜ in., so that the connecting-rod is not wide enough to resist transverse strains. This results in the rod springing, so that it is usual to find that the piston pin is not parallel with the crankpin after a very little use.

All piston pins at present in use are hopelessly inadequate in size; in many engines they are only ½ in. in diameter, and, while a few are larger, there are none to be found exceeding ⅝ in. As a piston pin ⅞ in. in diameter can be easily fitted into an 85 mm. piston, it is difficult to account for this preference for the small sizes used, especially as their life is extremely short. In spite of the many different ways in which piston pins are held in the piston, there is still a great deal of trouble caused through their working loose, although this is probably due to the fact that the small dimensions of the pin in the first place do not allow sufficient bearing in the piston bosses. Of all the different ways of

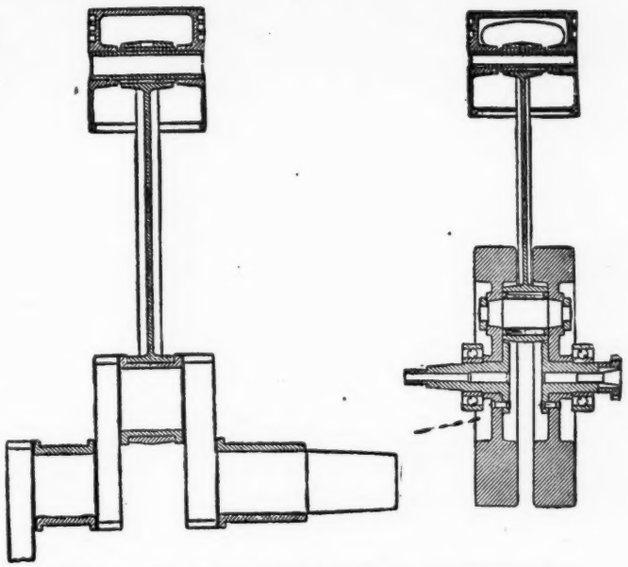


Fig. 2—Section of crank, piston and connecting rod, 90 by 130 mm. touring car engine and 85 by 88 mm. motorcycle engine

fixing piston pins, it would be hard to find a better than that employed for many years by a leading manufacturer, which is to make both ends of the pin of an exceedingly fine taper—one in 1600—and to drive it into a carefully reamed hole in the piston. When properly made, this gives an absolutely perfect fixing which never permits the pin to work loose. Although it appears an expensive method in the first place, it can easily be done on a commercial basis, to judge by the quantities which have been turned out.

Little can be said with regard to pistons, as we do not yet seem to have attained to any definite ideas as to what does actually form correct design. It is to be hoped that before long the aluminum piston will be thoroughly tried out to prove whether it is suitable for everyday use in an air-cooled engine, as if so, it presents distinct advantages in the way of lightness, better cooling and freedom from carbonization.

The subject of carburetion does not appear to have received the attention it deserves, as in spite of the long continued demand which has been put forward through the technical press for a truly automatic carbureter, the author does not know of a single British manufacturer who fits one as a standard. A certain number have been made, and one or two makes have attained a considerable measure of popularity, but the rider who wishes for one has to fit it at an extra expense after purchasing a machine; yet there is no doubt that if the motorcycle is to be placed on a level with the car, an automatic carbureter is a necessity. The present two lever type is an exceedingly primitive device, although in skilled hands it can be made to yield surprisingly good results. What we require, however, is an instrument which will give the best results independent of the skill of the driver, once it has been correctly set.

As the success of an automatic carbureter very largely depends on even suction, it is an exceedingly difficult thing to design a satisfactory one for a single-cylinder engine where the suction is only exerted for half a revolution out of every two, and then stops and starts again with a violent jerk. The conditions are nearly as bad with the irregular suction intervals of the Vee twin-cylinder engines, and it is only with the flat twin and the four-cylinder engines that conditions are obtained which render an automatic carbureter a success. These two types of engine can be fitted with any of the car type carbureters which are on the market, such, for instance, as the Claudel, or the Zenith, to name two well known examples, in which there are no moving parts except the throttle.

The flat twin engine appears to be subject to a good deal of trouble on account of the length of the induction pipe, as the two inlet valves are at opposite ends of the engine, but the

difficulties here should be easily overcome by exhaust jacketing the pipe and providing a hot air supply to the carbureter from a muff on the exhaust pipe. It is certain, too, that the heating of the air supply requires careful attention on a four-cylinder engine, as it has to be remembered that in the present state of development the motorcycle engine is running absolutely exposed to the elements, unlike a car engine which is closed up inside a bonnet, and always surrounded by fairly warm air.

The American manufacturers have progressed much farther than we have in this matter of carburetion, as their machines are universally fitted with an automatic carbureter, although they do not appear to be of the best type, insomuch that they are provided with too many adjustments which are under the rider's control.

Lubrication

As with carburetion, the lubrication of most English engines seems in an embryonic state, and in this respect, too, the Americans have a decided advantage, as mechanical oiling is universal on their machines. Very few English makers of a single-cylinder or Vee twin-cylinder engine appear to have got beyond a hand-pump or sight feed drip. The former over-oils the engine at irregular intervals, depending on the whim of the driver, while the latter is decidedly erratic, and requires frequent readjustment to suit the varying viscosity of the oil under different atmospheric temperatures.

It is satisfactory to note that the makers of the flat twin and four-cylinder engines have brought their lubrication systems into line with modern practice, which is a pump driven by the engine drawing oil from the bottom of the crankcase and delivering it into troughs into which the connecting-rods dip, the surplus oil running down through a filter to be used again.

For the sizes of engine we are dealing with, there is no need to consider forced lubrication with its extra complications in the way of pressure filters, relief valves, etc., which require periodic attention. When the trough system is employed there is no need to use any filter except a gauze tray below the troughs and covering the whole of the base. Its area is then so large that cleaning is never required between overhauls of the engine.

We can say that a correct method of oiling has been evolved, and it only remains for all makers to adopt it.

A brief acquaintance with motorcycle engines is sufficient to convince anyone that most valve gears are very noisy after quite a short period of running. Complaints are also general of undue noise from the exhaust, but we are never likely to have really effective silencers until the mechanical noises from the engine have been reduced, as, for a choice of evils, the bark of the exhaust is preferable to the scream of the timing wheels, though frequently in some engines at high speeds the mechanical noises drown the exhaust. The causes of noisy valve gear are chiefly the inadequate bearing surfaces through lack of space, and incorrect cam forms, particularly those of the internal variety.

With the conventional construction of crankcase with internal flywheels, the cams, wheels, bearings, and rockers have all to be packed into a space about 1¼ in. wide. This compartment is separated from the crankcase by a wall, and usually only gets lubricated in a haphazard manner by the oil mist which passes through the crankshaft ball bearing. Examination of a considerable number of timing wheels shows the bearing on either side of the wheel to have an average diameter and length of 10 mm., and it runs in a hardened steel bush pressed into the crankcase, rarely pinned in any way to prevent it rotating. The timing case cover carries the bushes on one side, and is seldom dowelled, and is only held on to the crankcase by means of screws with clearance holes.

The chances are that the bearings are never put up correctly in relation to one another, and as it is very difficult to get an adequate supply of oil into them, they all very soon wear slack, while the bushes get loose in the aluminum. Also with the loose fitting timing cover, the centers of the respective holes are out of parallel with each other, so that the whole mechanism is generally running out of truth on badly worn bearings, to the consequent accompaniment of the noise previously referred to. Although this type of timing gear does not lend itself to the best design, a considerable improvement could undoubtedly be made by mounting the wheels on ball or plain bearings of more adequate diameter, and dowelling or piloting the cover on the crankcase, or, as on one make of engine, carrying the bearings in a frame which is independent of the cover. Some better means, too, should be taken to insure lubrication of the timing gear, which can easily be done now that mechanical oil pumps have become a necessity for the engine of the future.

(To be continued)

Steaming of Vehicle Stock During Kiln Drying

SATURATED steam as a means of alleviating the tendencies of green lumber to honey-comb in the kiln has for some time been successfully applied in the commercial drying of heavy vehicle stock. Under intelligent control, such treatment has meant the difference between success and failure in many kiln runs.

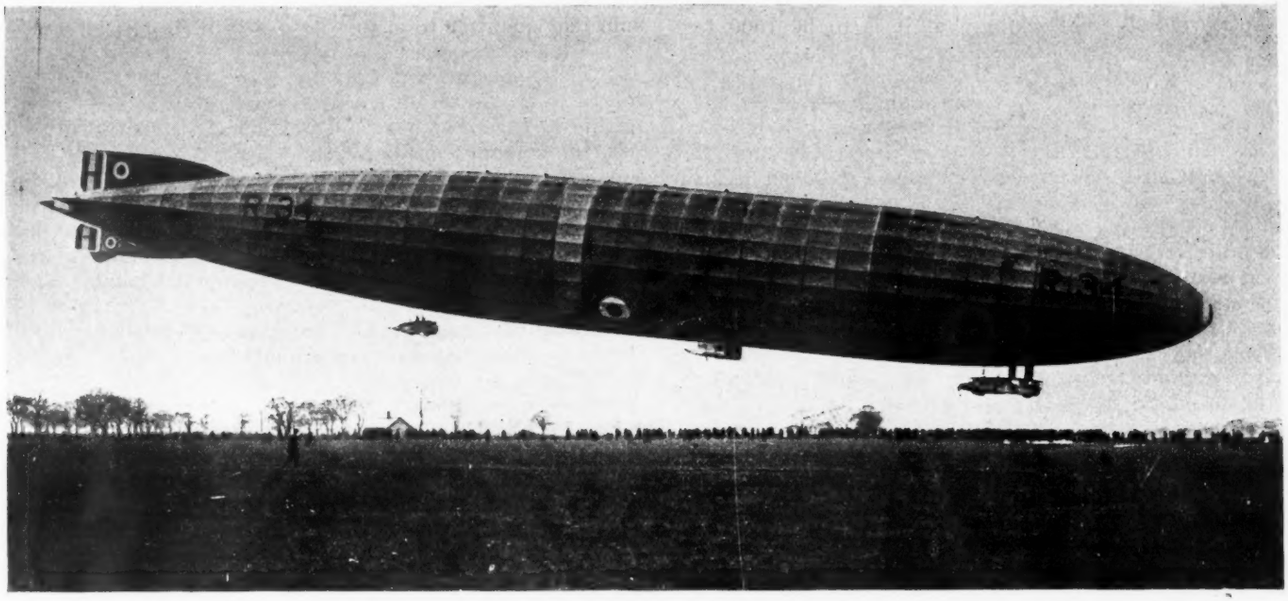
So far, however, the steaming treatment has been confined to straight stock. The contention has always been that bent stock, such as rims, should not be steamed after removal from the form, experience indicating that stock so treated would tend to straighten out to its original shape.

Recent experiments conducted under the direction of the Forest Products Laboratory have shown that judicious steaming of heavy bent vehicle stock results in a considerably improved product, and that the operation can be accomplished without serious effect upon the curvature. Careful judgment is necessary, however, as it is a very easy matter to ruin the entire charge by too severe treatment. Contrary to the common impression, this steaming has been done at high temperatures (150 to 180 deg. F.) and for short periods (½ to 3 hours), the temperature and time varying according to the requirements of the case.

The method was given a rather severe test, being tried first on 56-in. oak rims and later on 60-in. artillery wheel stock. When applied to the kiln drying of heavy oak rims on a commercial basis it worked out very successfully. Checks in the stock before steaming, which showed "pinching in" tending toward honey-combing, closed normally without further damage after steaming. From kiln charges totaling about 2400 pieces, the losses attributable to kiln drying were only 2 per cent.

Co-operative Manufacturing Suggested

IN discussing a paper on Jigs, Tools and Special Machines before the Institution of Mechanical Engineers in London recently, Herbert Carpenter said he would suggest that the Government should call the motor car manufacturers together and get them to form a committee to consider standardization. There were 200 or 300 cars on the British market, with not so much as a piston ring standardized. Such a committee might develop designs embodying the best features of every car, and a dozen types might be standardized, embracing light cars, taxicabs, trucks and delivery wagons, together with two or three other essential types. They could evolve five or six types of engine and one or two magnetos, while they could standardize carbureters, valves and piston rings. The making of small fittings could be specialized by the smaller firms, engines by larger firms, and motor cars by firms still larger. Wit hsuch a system, connecting rods should be produced at a cost of 20 cents per rod, and generally the price of cars be reduced to pre-war limits. It might be urged that the scheme would arrest improvement and invention, but he thought that a manufacturers' committee would be well able to judge of the desirability or otherwise of a proposed improvement.



The R-34, 670 ft. long, descending after her trial trip at Clydeside. Over 400 men and women assisted in launching this ship, which remained in the air 4½ hours

The Inauguration of Safe Aerial Transportation

Helium Gas for Balloon Inflation and the Likely Results of Discovery of Means for Producing It Cheaply in Quantity

By Harold F. Blanchard

THE complete safety of aerial travel is assured by the recent discovery of helium gas, or rather a method of producing it. With its use a dirigible airship may float as securely in the air as a ship at sea, and, in fact, more securely, as will presently be explained. Airships have always been considered safe, except for the bugbear of fire due to the use of hydrogen, that most inflammable of gases, to inflate the bag. But now helium, the only other gas that is sufficiently light, has been made available, and helium is just as fireproof as hydrogen is the contrary.

Already plans are being laid for the construction of mammoth passenger-carrying dirigibles resembling the Zeppelins, and these ships, luxuriously fitted, will presently ply by straight line routes between the big cities. They will be easily capable of making non-stop voyages half way around the globe, and even a complete circuit of the globe without a landing is not an impossibility. This is not a hackneyed prophecy uttered in a burst of enthusiasm, but the conservative conclusion that must be reached after due consideration of the facts, particularly the announcement of a process for producing helium recently made by the Navy Department.

The size and lifting capacity of the big dirigibles with rigid gas bags, and therefore called Zeppelins, are staggering, but are really only an earnest of what is to come. A modern Zeppelin has a gas bag approximately 650 feet long and 75 feet in diameter, and contains 2,000,000 cubic feet of gas; it has a total lifting power of 130,000 pounds, or 65 tons, 1400 horsepower and a speed of 75 miles per hour. Such a ship has a load capacity of 38 tons, or 58 per cent of the total lifting capacity, and has a non-stop cruising radius of several days, the distance depending on the speed and how much of the load-carrying capacity is used for fuel.

Such are the characteristics of the German Zeppelin. The British, with an eye to air supremacy, as necessary from their standpoint as their preponderance of sea power, have also developed this type. The *Daily Mail*, London, recently published the first particulars of one of the latest types of British rigid airships, the building of which has been done secretly. These vessels are known as the "33" class and are equal in size to the most successful type of Zeppelin, and preliminary tests have shown that they will equal, if not exceed, the Zeppelin performances.

The first of this type has been built for the admiralty and was originally designed for ocean-going war service. The craft has a length of 670 feet, a diameter of 79 feet and a capacity of 2,000,000 cubic feet. She will carry fuel for a continuous flight of eight days and a speed of at least 70 miles per hour is promised. Such a ship could easily travel half way around the globe, and yet, large as it is, it is small compared to what Great Britain is planning. There is under consideration by the admiralty a ship practically five times as large as this.

Complete details are lacking, but it is to be 1000 feet long, have a gas bag capacity of 10,000,000 cubic feet, and a lifting capacity of about five times, or roughly 200 tons. It will be driven at a maximum speed of 80 miles per hour by engines of 8000 horsepower. There is no limit to the cruising radius of such a machine.

It is difficult to visualize 38 tons, let alone 200, because the average man's experience with tonnage is limited to coal. Perhaps the most striking illustration is to compare the lifting power of these ships with that monster flying boat belonging to our Navy, which recently carried fifty-one men. This machine, perhaps the largest of its kind in the world, has a lifting capacity of only 6½ tons.

These big liners, equipped with all the luxuries known to land and sea travel, will carry passengers and freight to the corners of the earth and will also be used for safe aerial transportation between distant cities in our own land. Even a present-day Zeppelin would carry as many passengers as the justly famous Twentieth Century Limited, which runs between Chicago and New York, making the trip in 20 hours, which figure the big airship would more than cut in two.

On a basis of an 80-mile-an-hour speed, the time it would take to run from New York to various distant points is given below:

	Days
Melbourne	5½
Hongkong	5¼
Calcutta	4¾
Tokyo	3¾
Cape Town	3¼
Buenos Aires	2½
Petrograd	2½
London	1¾
Paris	1¾
Sitka	1½
Los Angeles	1¼

Up to the announcement of the discovery of helium conservatively minded people rightly questioned the safety of aerial transportation. The aeroplane is rather dangerous and likely to remain so, and the airship filled with inflammable hydrogen was likewise out of the question. The sudden destruction of several Zeppelins in flames and the memory of our own ill-fated Vaniman, who lost his life when the machine with which he was attempting to cross the ocean took fire in sight of the Atlantic coast, give sufficient proof, if any were needed, of the hazard of hydrogen.

Helium Is Non-Inflammable

But the production of helium gas in quantity has completely eliminated the fire risk. Helium is a non-inflammable gas somewhat resembling nitrogen, except that it is much lighter. Its existence has been known for a good many years, but until recently so difficult was its extraction that not more than a half dozen cubic feet were ever segregated in one container.

Compared with hydrogen it has a lifting efficiency of 93 per cent. Next to hydrogen it is the lightest gas known. Although its weight is twice that of hydrogen its buoyancy is 93 per cent because of the relatively high weight of air, which is approximately 14.4 times that of hydrogen. Eight per cent greater volume of helium is required to give a lifting power equal to hydrogen, but this difference is not sufficient to cause any difficulty.

The production of helium in quantity is a result of the war. When the United States entered the conflict, Great Britain turned to us for co-operation in solving many problems which would aid in terminating hostilities. Among many others the problem of producing helium in sufficient quantity to enable its use in dirigibles in place of hydrogen was presented.

Uncle Sam, as typified by the Bureau of Mines, scratched his head and looked around, first to see where in this vast country helium was hidden in sufficient quantity to warrant consideration. His card index of the country's resources told him that helium occurred in various places, in the air, in certain minerals and mineral waters, but in exceedingly small quantities. But the natural gas coming from Oklahoma, Kansas, Texas and Ontario contained 1 per cent of the coveted helium, and this source held out great promise.

Pure helium was obtained from natural gas by a very simple process. Natural gas is a mixture of several gases and helium has the lowest boiling point of any of the constituents, so that by cooling the gases down to a temperature of 317 deg. below zero Fahrenheit, all were liquefied except helium. A method for producing helium on a grand scale along these lines was developed by the Linde Air Products Co., and the Navy Department forthwith gave them a contract for erecting buildings and equipment to the value of $900,000 at Forth Worth, Tex., with the understanding that they should be ready for production in April, 1919. The plans also include a 10-in. pipe line from Petrolia, Tex., costing $1,000,000. Although the plant is not yet in operation, it is estimated with accuracy that the cost of helium will be as low as $100 per 1000 cubic feet, and with increasing use it will undoubtedly go much lower.

There is no brighter page in the romance of chemistry than that devoted to this gas, and inasmuch as the history of its discovery and development is very closely linked with its present production in quantity it is worth while to stop a moment and briefly review it.

Helium Found in Sun Spectrum

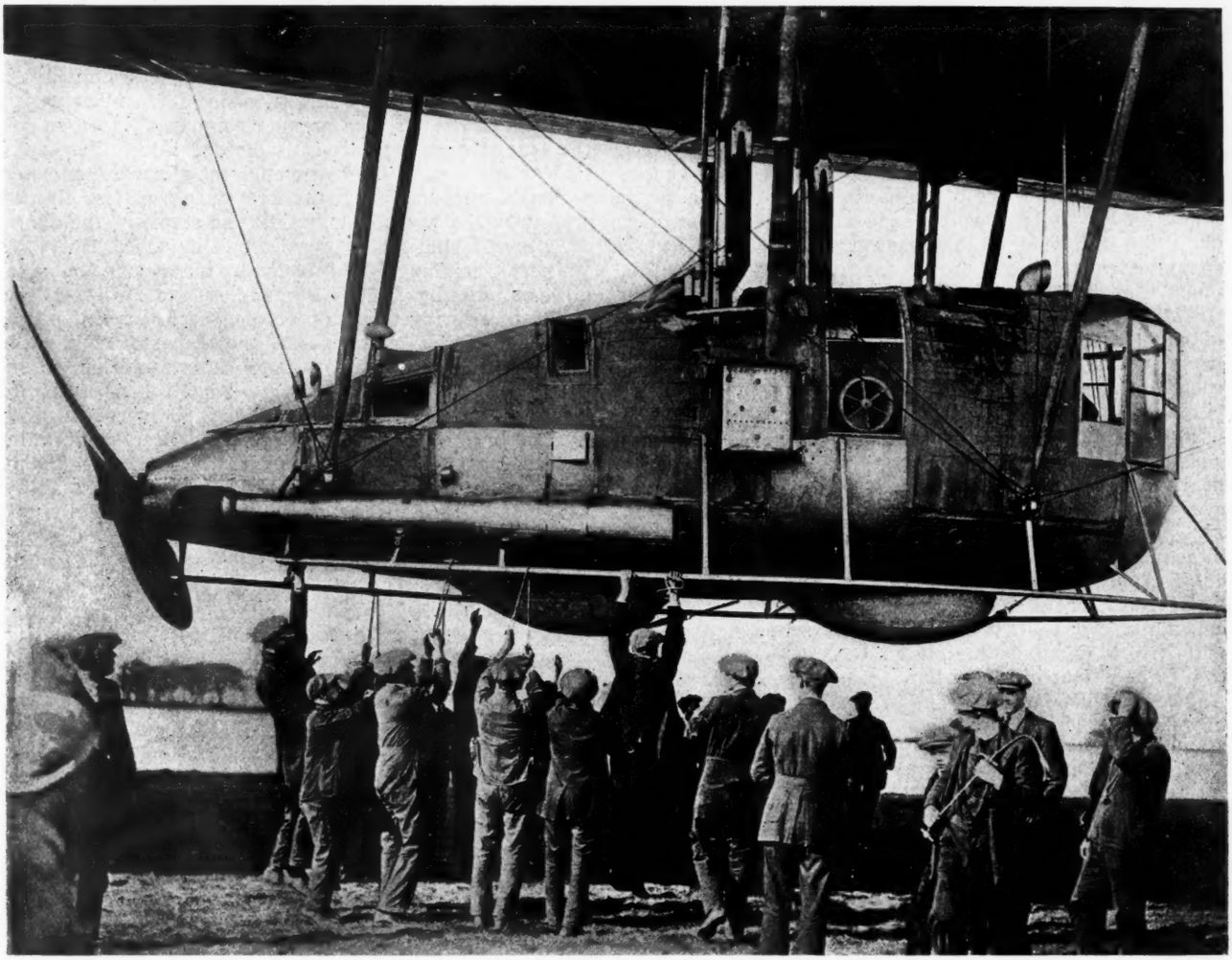
It takes its name from the Greek word helios, meaning sun, because its presence was first noted in the incandescent atmosphere surrounding the sun. Every incandescent substance emits a certain definite color, yellow for carbon, lavender for potassium, green for copper, and so on, and a mixture of the elements in the sun's atmosphere combines to give white sunlight. Therefore, if a beam of sunlight is split up into its constituent colors by passing it through a prism and they are thrown on a screen, the colors show what incandescent substances are producing them. This is spectrum analysis. During an eclipse of the sun visible in India in 1868 a noted French astronomer discovered some brilliant yellow lines in the spectrum not produced by any element known at that time.

Investigation by him and others proved that it was indeed a new substance, and, appropriately, was christened helium.

Years later traces of it were discovered on the earth. Careful analysis of the air we breathe showed that one part in 245,300 was helium, spectrum analysis proving that it was identical with the element earlier found in the sun. It was also found in certain minerals and mineral waters, but only in very small quantities, held there by occlusion; that is, it was not chemically combined, but held by mechanical means, the same as water in a sponge. So difficult was it to extract, and so rare, that it cost several thousand dollars to produce even a few cubic feet of it.

Perhaps its most interesting use up to the present time is to produce the coldest temperature known to man, namely, 455.8 below zero Fahrenheit. This low temperature was produced by evaporating liquid helium.

Its connection with radium, that magical substance, is worth mentioning, in that it suggests the reason for find-



The R-34, England's greatest airship, was launched from Clydeside. The rear gondola is shown here, giving view of observation glass window and car construction

ing it in natural gas. Silver cannot be changed into gold, so the modern alchemists have told us, basing their argument on the immutability of the elements. True, this has never been done, but it may surprise a lot of men who have not opened a chemistry book since they left college to learn that helium, a chemical element, is produced from radium, another chemical element. Radium is unstable, and decomposes into niton and helium. Niton itself breaks up, and metallic lead (supposedly) is the eventual result. So helium and lead are automatically transmuted from radium. Therefore, it is suggested that the helium in natural gas is a product of the decomposition of the radium held in the bowels of the earth.

Just how fireproof helium is is most strikingly illustrated by a test made by the government. A small balloon was filled with the gas and a blow torch applied to the silk fabric until a hole was burned through. Then the torch was removed, and a most remarkable thing happened. The helium poured out of the hole and quickly suffocated the flames, which were slowly eating the silk and enlarging the hole. Based on this observation, the man who is perhaps the most experienced dirigible pilot of the Navy has suggested that the helium gas in the dirigible bag be used for fire protection throughout the car which hangs from the bag. It could be piped, the same as water, to various points in the car, so that in case a fire broke out a jet of helium would quickly extinguish it.

Let us return to the consideration of the airship itself. Weight is not such an extreme consideration as in the airplane, and, therefore, we can expect to see ships with luxurious saloons, dining rooms, cabins, and the like, green carpeted, and finished in mahogany. There will be a promenade walk the full length of the ship for exercise and observation. Quarters will not be cramped, as they must be in large airplanes now talked of.

The estimated speed of 80 miles per hour is conservative. The big airships of the Zeppelin type, with their enormous bags, drive through the air at 75 miles per hour. Even the relatively small non-rigid type developed by our Navy, with a bag approximately 250 ft. long and 40 ft. in diameter, runs just under a mile a minute with a horsepower development of only 300.

Curiously, the speed rises with the size, so that it is not exaggerating the case to expect that the big air liners will run 80 miles per hour.

To the man who knows how much power it takes to overcome the wind resistance and friction of so small a thing as an automobile, the relatively low power required to project the airship through space is most astonishing —almost uncanny. It requires about 100 horsepower to drive a large touring car along at a rate of 70 miles per hour, and yet the relatively enormous bulk of the Navy dirigible just mentioned requires only three times the power to proceed at nearly the same speed.

The cruising radius of an airship with a 200 to 300-ton

carrying capacity, as already suggested, would be almost unlimited. In this respect it has two advantages over the airplane: Its percentage of weight-carrying ability increases with its size; and the power required, and therefore the fuel needed, is very small compared to an airplane; yet the airship, with its superior carrying ability, has really more room for fuel than the plane. To be specific: The big seaplane mentioned can carry 6½ tons, and requires 1000 horsepower, or 154 horsepower per ton. The big airship, on the other hand, carries 38 tons with a horsepower of 1400, which is used for propulsion only, or a ton for only 36 horsepower. From this simple computation it is plain that it takes about four times as much fuel to transport a ton by airplane as by airship. Or allowing the same space for fuel in two machines of equal carrying capacity, the airship would run four times as far. The speeds of these two machines are roughly the same.

It would be quite possible to build a large airship which would run at its full speed of 80 miles per hour for a whole month, and during that period to circle the earth nearly two and one-half times. Not that any one will ever want to perform such a feat, but it does show the possibilities of the airship. It will be of greatest use in connecting cities separated by vast expanses of water, or land undeveloped by railroads. Its availability to reach the corners of the world quickly is particularly appealing. At the same time it will compete favorably with trains and airplanes, even within the confines of the United States. The trip from New York to Los Angeles might be made in 1¼ days, and shorter distances in relatively less time. Even such a distant point as Melbourne is only 5½ days out from New York; and Buenos Aires, Cape Town, and Hongkong are respectively 2½, 3¼ and 5¼ days.

It seems hardly necessary to point out that the speed of the dirigible is three to six times that of a steamship, twice that of an express train, and equals the speed of a large airplane. Of course, it does not approach the enormous velocities of the small, fast machines, but it is very doubtful whether these extreme speeds of 160 miles or better will ever be attained in commercial passenger-carrying work. Perhaps 120 miles per hour is a fair maximum for fast passenger airplanes. However, it is not so certain but that a dirigible could be made to compete at this speed. With increasing airplane speed, first and operating costs mount rapidly, and at the same time carrying capacity is reduced and frequency with which stops must be made to take on fuel are increased.

It is not the aim of this article to attempt to prove the superiority of the dirigible over the airplane, but to show what the usefulness of the airship is going to be, and to drive home this point it is necessary to compare it with other vehicles of transportation, and airplanes particularly, since competition will be closest between these two.

The Landing Problem

In passing, it is only fair to remark that many thinking people do not look upon the airplane as a future universal means of travel, and there are a large number of aviators, and even some airplane manufacturers, who also hold this view. Lest this statement be misunderstood, let it be added that this does not mean that there will not be many, many airplanes used both for business and sport, but that their number will not be as great as many people like to suppose. After eliminating all other danger factors—fire, derangement of controls, and the like, in order to put the best face on the case—there is still the problem of a *safe* forced landing to be considered, something that may be called for in cross-country flying with even the best imaginable machine. A fence or a ditch, not to mention telegraph poles, trees, and houses, might cause disaster. Landing on the sea is safe except in rough weather.

It is hardly too much to say that a helium-filled dirigible offers at least as safe a mode of travel as a ship. It floats in the air in a manner comparable to a ship on the sea. Its big, rigid bag is divided into bulkheads, so that even a rent in the bag would not affect the buoyancy seriously. It floats at least as securely in the air as a ship upon the water. So, unlike the airplane, the danger of a forced landing is practically eliminated.

There remains the problem of foundering on trees, hills, or buildings. This is a remote possibility, as rare as the foundering of a ship at sea. With present perfection of dirigible control, and knowledge of navigation there is no cause for serious apprehension on this score.

Fog does not present the same danger for the dirigible as it does for the airplane. The former may reduce speed, or stop, but the latter must keep on, at least at its minimum flying speed, which is not less than forty miles per hour, and usually nearer sixty. Nor can fogs always be avoided. Perhaps the greatest danger for the dirigible in a fog will be airplanes, but fog horns should reduce this liability to a minimum.

Wings Cause of Trouble

On the other hand, consider the flying boat. It is hard to conceive of one so large that it will, when forced to land, ride a rough sea with safety. The difficulty lies not in making a seaworthy hull on which to mount the wings and tail. Even the hulls of the present-day flying boats, with lengths of 40 to 60 ft., and beams of 6 or 8, are quite seaworthy *per se*. It is the wings, stretching far out to each side, which cause the trouble, the angry waves battering them until they break up, and with them the whole boat gradually swamps. It is difficult to imagine a flying boat so large that it would be seaworthy in rough weather.

However, assuming that it would resist a rough sea successfully until the necessity for a landing was passed, engine repairs, dense fog, or what not—the man who believes that flying boats will never be forced to land is too optimistic—there is the problem of getting off the rough water into the air again. Skimming the surface of the water at 50 or 60 miles per hour is no joke when it is rough, and even if the boat escapes serious injury there is the certainty of missing teeth or even cracked skulls among the passengers as a result of the rough getaway.

Rising from even a moderately rough sea is a serious matter, as the few naval aviators who have accomplished it will testify.

According to present-day experience, a flying boat which lands in stormy water is doomed. Fortunately, there has usually been a ship near enough to rescue the passengers, but the boat has invariably been lost, unless there was a means for lifting it on board. Towing a flying boat at a greater speed than 4 miles per hour is out of the question; it will not stand up at a higher speed, and yet this is too slow to allow navigation of the rescuing vessel.

Curiously, experiments have just been successfully completed in which a dirigible acts as the rescuing vessel, picking the disabled plane up bodily and carrying it to shore. This expedient was hit upon as a means of rescuing disabled flying boats that would otherwise be lost.

It is argued that the multi-engined plane of the future should never be forced to land, inasmuch as it is not likely that more than one engine will refuse to run at

one time. But this view is debatable, although there is not space to discuss its technicalities here.

No comparison of fire hazards in airplanes and airships is attempted, because the indications are that these will presently be practically eliminated in both.

Docking of a big airship presents some difficulties, but with the special facilities which must certainly be developed it should offer no more risk than bringing a large ocean liner to its berth.

From the standpoint of comfort, the roomier airship should prove preferable to the airplane. As to steadiness, the advantage, if any, is in favor of the plane, the air liner having a tendency to roll and pitch. Engine noise should be less in the dirigible; in fact, there is no reason why it should be greater than in the modern automobile, for high power and low weight can be subordinated to quietness, and the engines may be well muffled. The difficulty in quieting an airplane engine lies not in the extra weight and wind resistance of the mufflers, but in the fact that their presence reduces the possible power output, not directly by causing back pressure, as in the automobile, but by producing valve trouble. So it is a safe conclusion that the dirigible will be much quieter than the airplane.

The dirigible will offer a better view of the land underneath, since it can be operated with safety at a low level—1000 ft. is about right for the best view—while the airplane will soar at 5000 ft. so as to increase its gliding radius and allow a large choice of landing places in case of an urgent landing.

There seems to be no limit to the size of a dirigible but there is a limit to the size of the airplane, if the word of F. W. Lanchester, a noted English authority, may be accepted. Various considerations fix the maximum wing span at 160 ft., and there are also limits to the depth of the wings and to their number.

The weight-carrying capacity of the airship increases with the size, while the weight-carrying capacity of the airplane remains constant at about 33 per cent. It is estimated that large dirigibles will be able to carry a useful load of 70 to 75 per cent of their total lifting capacity, and even the large machines of to-day carry 60 per cent pay load.

Helium-Filled Dirigibles Logical for Commercial Use

The cost of an airship is, of course, many times that of a large airplane, but in comparison with a large airplane there is little difference, the cost per ton useful load being about the same.

So, viewing the matter from every angle, it is reasonable to expect to see large fleets of helium-filled dirigibles carrying passengers, valuable freight and mail to the far corners of the earth, speeding up intercourse at such an enormous rate that commerce and the march of civilization, interlinked, will grow far beyond the dreams of even the most ardent champions of aerial transportation.

The military use of the helium dirigible is particularly attractive. Its size and ample weight-carrying capacity permit it to carry an enormous number of bombs for use against submarines, particularly, but also for night bombing. It will also undoubtedly be of service in bombing enemy war vessels when used in connection with fighting planes, and perhaps also war vessels working in conjunction with it.

It will undoubtedly be equipped with small caliber guns for offensive use on both land and sea.

It will be invulnerable to enemy airplanes except against bomb attack. The weakness of the dirigible heretofore has lain mainly in the inflammability of the gas used in the bag, a few well-placed incendiary bullets quickly setting the machine in flames and destroying it, but with a non-inflammable gas, machine-gun fire will have practically no effect. The enormous bag might be fairly riddled with holes without causing a serious loss of gas. By armoring the vital parts, such as the engines, machine-gun fire would have little effect on the operating mechanism.

All of this is assuming that an airplane would dare venture near this new aerial monster. But with numerous machine guns and small-caliber guns for defense, it is doubtful whether any airplane would accept the risk. This circumstance is perhaps best illustrated by the experience of the British with the enormous flying boats which they used for submarine patrol work in the North Sea. These boats carried several men, had a wing spread of about 100 ft., and were equipped with two large Rolls-Royce engines. When first put into service some were lost in unequal combat with several fast enemy planes, the big boat being too slow to run away and being insufficiently armed to put up a fight. Presently, however, these big boats were armed with twenty machine guns, in pairs, and soon after one of them was sighted by a squadron of ten enemy planes. As is customary, it descended close to the water, so that it could not be sought from its blind spot under the large hull, and waited for the attack. The fight was soon over, for its twenty machine guns quickly accounted for all ten planes. Due to the total destruction of the enemy force, no inkling of what happened to the squadron reached enemy headquarters, with the result that shortly thereafter another squadron of ten appeared over the sea and gave battle to another one of these big boats which had formerly been such easy prey. One lone machine escaped from the fray and straggled back to Germany with the news. After that, enemy squadrons were very careful about attacking large flying boats until they had determined the power of the armament.

The point is obvious. If a large airplane is so nearly invulnerable against machine-gun fire of enemy planes, how much more so would the big dirigible be, with opportunity to install almost any number of guns with which to bring them down or ward them off? Even if an attacking machine did weather the storm of lead hurled against its practically defenseless and exceedingly vulnerable structure, and came close enough to insure accurate shooting, it is doubtful whether it could do any damage worth considering.

It may be objected that the monster airplane would at least be the equal of the air battleship, but the enormously greater carrying capacity of the latter would always permit a preponderously superior armament. Nor would the big airplane possess a tactical advantage because of greater speed, because the airship can at least equal it in this regard.

The big aerial warship is therefore an exceedingly formidable weapon, and has nothing to fear seriously as long as it keeps out of range of anti-aircraft guns on land and sea. It is quite certain that the navies of the future will have large numbers of these craft for offense, defense and observation.

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Michigan Carries $50,000,000 Good Roads Bonds

MICHIGAN voted overwhelmingly in favor of the $50,000,000 good roads bond issue, the project carrying in nearly revery precinct by a 4 to 1 vote. The campaign for the good roads movement was directed by the Michigan State Highway Association, backed by every automobile club and chamber of commerce in the State.

The project authorizes the State to borrow for the improvement of highways and to issue bonds not to exceed $50,000,000. It provides that counties bear from 10 to 60 per cent of the cost.

Review of English Labor Conditions

Trade Union-Manufacturer Agreements — Shop Steward System — District Allied Trades Council

REASONS FOR PRESENT LABOR UNREST INDICATED

By Harry Tipper

IN view of the reports which have just been made public, of the commission which was appointed to deal with the dispute between the coal miners, the owners and the Government and the general industrial commission, it is important that the background for the situation in Great Britain should be understood.

It is obvious that the results of these congresses of capital, labor and Government together, in Great Britain, will have considerable bearing upon the situation as it develops in this country, although the conditions are so different in that country that the methods adopted there would not be of immediate value in our considerations here.

The wide discussion which these measures are causing and the enthusiasm which they are creating in a good many quarters, where the difference in background is not understood, make it all the more important that the same consideration should be given to the conditions out of which these triangular agreements, or decisions, have arisen.

The custom of making agreements between the manufacturers individually, or in groups, and the trade unions interested in those manufacturing operations, is an old one in Great Britain. For at least twenty years there have been agreements between the engineering trades and the trade unions concerned in these special operations, which involve the question of shop committees and which involve the system out of which has grown the shop steward arrangement.

Union Agreements Made 35 Years Ago

The union has been accepted as a necessary means of arriving at arrangements in Great Britain during a period of from twenty to thirty-five years in the different lines of industry. For that reason, the question of the merit of collective bargaining in this way and of agreement upon matters of hours and wages, etc., through the trade union, in Great Britain, does not enter into the discussion. This historical background of usual practice in dealing with the local trade union and the national body in arriving at agreements upon matters affecting the workers has led logically to the situation which is indicated by the triangular conferences between labor, capital and Government as they exist to-day in Great Britain.

It is now some thirty years since the Labor Party, as such, entered into politics in Great Britain actively as a party. Originally this party began with the desire of the trade unions, or the workers, to be represented in the Parliamentary discussions, and the first representatives in Parliament were paid by the trade unions because there was, at that time, no payment of Parliamentary members by the Government. The writer recalls very well the meetings which occurred when the workers of the Lancashire district decided to secure representation in Parliament.

In the course of time the Labor Party as a political body, because of the similarity between its aims and the necessities of a good many of the smaller professional and other types of independent workers, extended itself and secured support from the small shopkeeper, the office worker, the professional class and the other brain workers to a very considerable extent. As a consequence, the influence of the Labor Party has grown out way beyond the original conception of the trade unions in desiring Parliamentary representation and has brought into the platforms of the Labor Party, as a political organization, a great many questions with which the trade union, as such, was not particularly concerned. In the meantime the growth in public power, through the organization of the Labor Party as a political entity, has strengthened the hands of the trade union in extending the organization of other workers into the ranks of the trade unions and in federating the different unions for purposes of organization upon public matters. Furthermore, the practice which began twenty or thirty years ago, of deciding such industrial questions as wages, hours and labor production and methods of operation, through the trade union, itself increased the power of the trade unions and the advisability of all workers aligning themselves with the unions. These considerations meant that at the beginning of the war the industrial workers in Great Britain were organized to the extent of a majority of the workers in the most important industries and in many industries almost exclusively so organized.

When the war broke out it was necessary for the Government, in its preparations to meet the enormous tasks imposed upon the country by the necessities of the war, to use this organized machinery of the workers to provide the means of selecting the essential workers, of diluting labor and of obtaining a more or less smooth and efficient continuance of operations. This was recognized by the Ministry of

Munitions, but the usual inefficiency of the Governmental bodies affected the results so that there was continual cause for dissatisfaction on the part of both workers and manufacturers, and these unsatisfactory methods of procedure were largely responsible for the number of strikes which occurred during the war period in that country.

For instance, the question of naming the essential individual workers and issuing cards to them was at first left in the hands of the local trade unions with the obvious result that great abuses crept in, producing dissatisfaction among the workers, trouble with production, and without properly accomplishing the purpose. This method was changed before very long and the method was adopted which was continued through the rest of the period.

In order to secure the adherence of the trade union organizations to the immediate purposes of the Government in prosecuting the war, it was necessary for the Government to promise these organizations that the privileges which they voluntarily abandoned should be restored to them when the war was over. It is due largely to the difficulty of restoring these privileges at once that the unrest occurred which has resulted in the conferences that have just closed.

A very discerning British manufacturer, with whom we have had the pleasure of talking just a little while ago, made the statement that the labor organizations, as such, were just revelling in their first knowledge of controlling power, and when they had been obliged to shoulder the responsibility which goes with such power, for a sufficient period of time, the situation would develop into satisfactory compromises.

Not only is the power of labor thoroughly organized and recognized in the discussion of labor questions so that treatment between labor organization and manufacturer has become the usual practice, but well defined systems of conference have grown around this power, which vary in practice from the systems that have been adopted in the United States and which lead to an entirely different necessity in present negotiations and those of the immediate future.

The shop steward system in England is one which has been in use for about twenty years and which has grown into a complete system in about the last ten years. The shop steward is the liaison between the workers in a department and the foreman. If the rules as expressed in the agreement between the trade union and the manufacturer are not lived up to, he can carry his grievance to the management. Collectively the shop stewards in a plant form a workers' committee, inasmuch as they are appointed by the workers in each department and are paid by the workers for the time which they must spend upon their shop steward duties. Together with the representatives of the managers they form a conference committee, and this practice has obtained in the engineering and some of the other industries for a number of years. While these shop stewards, together with the management, form a conference plan or joint shop committee, this whole system is bound by and affiliated with the trade union and the manufacturer's group, so that it must operate within the agreement between the union as a body and the manufacturer and be subsidiary to such an agreement.

It is not in itself, therefore, a complete system of co-operative responsibility in connection with the individual factory or manufacturing unit, but simply provides working machinery in the individual manufacturing unit whereby the decisions and agreements arrived at between the trade union and the manufacturer can be kept in orderly operation. The growth of the shop steward system, leading to this conference plan affiliated with the unions, has led to the formation of what is termed the District Allied Trades Council, which consists of representatives of each union in the district in alliance, for the purpose of keeping the district in uniform practice in respect of matters relating to wages, hours and working conditions. This District Allied Trades Council is the bone of contention between the manufacturer and the union organization and has been the seat of revolt against the federated trade union on many occasions during the war and afterwards. In other words, the District Allied Trades Council has secured by its organization sufficient power in its local district to take the power away from the central organization and threaten to disturb the traditional method of agreement between the nationally organized union and the manufacturer's group. Furthermore, this District Allied Trades Council follows the local demand for action much more quickly and much more definitely than the centralized body and is apt to favor the radical demand, which gives more hope of satisfying their immediate constituency in their desire for action rather than deep consideration.

Intensive Force of English Organized Labor

When it is understood that this general condition in the industrial fields in Great Britain is coupled with the desires of a class of great solidarity, homogeneous in its growth, permeated with pretty much the same ideals and the same political outlook, the intensive force of organized labor and its great influence upon the future development of Great Britain politically and economically can be understood.

Great Britain is the oldest machinery manufacturing country in Western civilization. Its generations of workers have worked upon the same line of work from one to the next generation. They have lived in the same towns, they have been imbued with the same ideals, intensified by their definition and application and the homogeneous character of the people. It is for this reason that co-operative societies, organized by workers, have had such a large success in that country, and it is for this reason that profit sharing has made so little headway. These differences need to be thoroughly understood in this country if the developments which are taking place on the other side are to be understood properly in respect of their applicability to our problems and the modifications which must arise in our methods due to the difference in the conditions.

Turning Out 100 Tractors Per Day

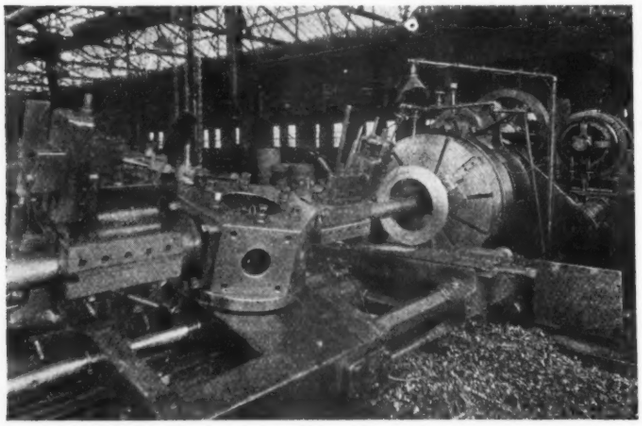
PART II

Production System Employed at the Milwaukee Plant of the International Harvester Co.—Details of Machining and Assembling Methods

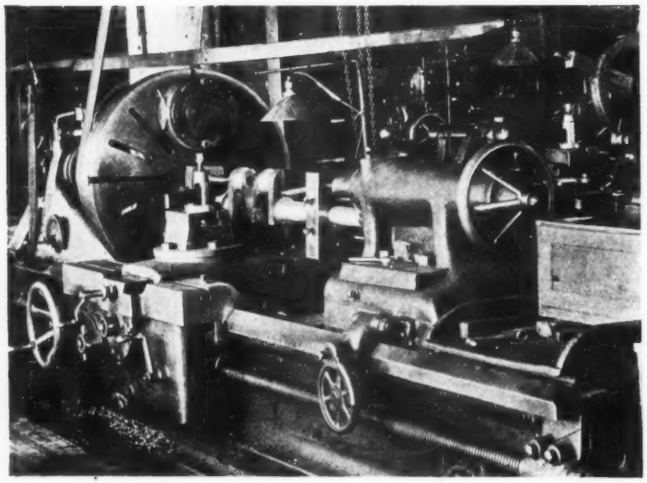
By P. M. Heldt

MOST of the fifth floor of the International Harvester Co. is devoted to the manufacture of piston rings. These are made from the usual cast-iron pots, and are of the eccentric type. Boring out the pot, turning off the outside eccentrically and cutting off the rings are performed in one setting. The lathe carriage carries the boring tool; the turning tool has a sliding mount and is moved back and forth by means of an eccentric pin, and the rings are cut off by means of a multiple cutting tool on the back of the lathe which is fed in toward the axis of the spindle as the carriage with the boring and turning tools progresses toward the lathe head. The cutting-off tools, of course, are so set that the outermost ring is detached first, then the next, and so on, so that the boring and turning operations on any ring are always completed before it is cut off.

All keyways are cut by broaching, and the broaching process is very extensively used in the plant. For instance, all sliding gears are bored out, and then have a square hole broached. All of the small gear blanks are finished in double spindle turret lathes. The small bevel gears are cut on three spindle cutters and the large bevel gears on two spindle cutters. The reverse gears are cut on three spindle machines, six gears being put together on an arbor and cut at the same time. Every gear is tested for trueness on a special testing machine. The broaching and gear cutting work here described are also done on the fifth floor.



One of the large turret lathes



Operation of turning connecting rod bearing faces on the crankshaft

On the fourth floor there is a miscellaneous collection of machine tools, including drills, lathes, etc. Here the steering knuckles are machined up. These are drop forgings, and are subjected to a heat treatment which increases their scleroscope hardness from 28 to 45. In order to provide a proper surface for the rollers of the roller bearings to roll on after the heat treatment, the knuckle is straightened in a straightening press, and is then tested by means of a dial gage.

Practically the whole of the third floor is devoted to tool making, making of dies for sheet steel work, and to tool service.

A platform has been erected in the yard, level with the second floor of the machine shop, so that castings from the foundry which are intended for the second floor of the machine shop can be deposited on this platform by means of the outside crane, and then transferred directly to the second floor of the shop, thus obviating unnecessary congestion of the main floor. Metal shavings from the machine shop are loaded on to cars in the yard in the same way.

Finishing the Crankshafts

On this floor the crankshafts are finished up. Owing to the motor being a two-cylinder machine, the crankshaft is comparatively simple, but a number of interesting machining operations have been evolved. Thus two crankshafts are milled at the same time for counterweights. The crankshafts are drilled for oil delivery to the crank pin bearings. Both ends of the crankshaft forgings are sawed off in power hack saws at the same time, and then center-drilled at the same time. In order to conserve human energy as much as possible, a monorail is installed under the ceiling of this floor, and all crankshafts are handled by blocks and tackle in transferring them from one machine to another. The camshafts are also turned up and ground in this department. The crankshafts are rough turned, finish-turned and ground, and very fine limits must be worked to, as the tolerances on the crank pin are + 0.0005 in. and — 0.001 in. A lapping tool of the nut cracker type is sometimes used, if it happens that a pin or main bearing is very close to the proper size. The camshafts are rough-machined on the round portion and the cams are rough ground, after which the shaft is heat treated. Then the whole is finish-ground.

On the ground floor there are miscellaneous machine tools, including key-way cutters, lathes, drill presses, etc. Both ends of the connecting-rods are bored out at the same time, and after boring they are reamed at the same time. The rods are next put into the milling machine and have the caps cut off and the lugs milled. At this setting, one slitting and two surfacing operations are performed at each end. Flywheels are turned up in a vertical lathe, and are balanced on a static balancing machine. By means of a horizontal mul-

General view of the main assembly room of the International Harvester Co. Here assembly of the clutch, flywheel, pistons, connecting rods, oil leads, muffler, etc., is carried on in the aisles under the balconies. The tractors are then moved around the ends into the main aisle, where the assembly operations are completed

tiple spindle drill, holes are drilled in the flywheel arms for the bolts by means of which the friction clutch pulley is secured to the flywheel. In drilling these holes, the flywheel is centered on the tail stock and a template is used in locating the holes. The friction clutch pulleys are turned up in a heavy turret lathe.

All heavy work is done in the main machine shop, which has one center aisle and two side aisles. Three overhead cranes run on a craneway extending the whole length of the building. Each heavy machine tool has its own air hoist on an arm swinging from a post. In this department there are many heavy continuous millers, as well as large boring machines and drills. Both sides of the crankcase are face-ground on a diamond face miller. The cylinder blocks are milled off at both ends and at the top, in an Ingersoll continuous milling machine in one setting. There are four Foote-Burt two spindle boring machines for boring and reaming crankcases in one setting. A radial drill press is used for spot-facing the surface around the bolt holes of the crankcase on the inside. Four Baush multiple spindle drill presses are installed for drilling and tapping all of the holes in the crankcase, using a jig for locating the holes. Next there are two large continuous millers, one for milling the crankcase, the other for milling the lower half of the transmission case. The former operates with four cutters, of which two are arranged vertically and two horizontally. Many of these machines are fitted with turntables, so that the machine can be loaded at the same time that it is working.

An interesting method is employed for moving the flywheels over the floor. A steel tube is put through five of these flywheels and then a bent bar, forming a handle, is hooked into the ends of the steel tube, whereupon it is possible to roll the flywheels over the floor, the same as a wheelbarrow.

A horizontal milling machine is used for facing the bearing slots in the crankcase. and six of the cases are clamped on the carriage of the machine at the same time. Another continuous miller, with six cutters, operates on two rows of crankcases (8 in all) facing off the top surface and the surface to which the cylinders bolt. A number of other continuous millers are used to finish the frame support faces on the upper half of the transmission case, the cases on each machine being strapped on the carriage in two rows, and the machine being provided with four cutters.

Boring and Milling Operations

After the transmission case halves have been fitted together, the ends of the bearing hubs are milled off, three cases being placed in the machine at one time. There is also in this department a battery of eight boring mills for boring and facing operations on the flywheel, and facing the lower half of the crankcase. A double-ended boring mill serves to bore in one operation the bearing hubs at each end of the transmission case and the reverse gear eccentric shaft holes. The holes in the crankcase are drilled in a multiple spindle drill, and another similar machine serves for tapping these holes.

The holes for bolting the driving sprocket wheels in place are drilled in a multiple spindle drill. Then the wheel blanks go on to an automatic gear cutter that finishes the sprocket

teeth in one operation. Both sprocket wheels on each tractor are interchangeable, there being no rights and lefts. There are four of the automatic gear cutters working on driving wheels.

Pistons are made in one of the galleries. The first operation is to face the open end in a turret lathe, and all subsequent work is located from this machined surface. Next, the piston goes into the drill press for boring the piston pin hole. It is then put into a Potter & Johnston lathe for roughing the outside surface, the top surface and the ring grooves, and then into another one for finish cutting. Next, oil holes are drilled through the piston wall, and the hole for the piston pin set screw is drilled and tapped at the same time. Holes are also drilled for pins for the piston rings. These pins are located one-half in the groove and one-half in the solid metal, and after they have been screwed tight, they are cut off with a hacksaw. After the final grinding of the piston, these pins are slightly relieved by means of a file, so that they will not project above the surface of the piston when the latter is hot, owing to the greater expansion of steel as compared with cast iron. After the pistons have been rough-ground, they are set aside for a while, which gives them a chance to age or relieve themselves of internal strains, after which they are finish-ground on the same machine. The final grinding of the pistons has to be held within limits of + 0.001 and — 0.001 in. Next, the cross hole is finish-bored and reamed in a lathe. A special clamping jig is used for holding the piston to the face plate of the lathe, and there is a taper centering pin on the turret for squaring the piston in the jig.

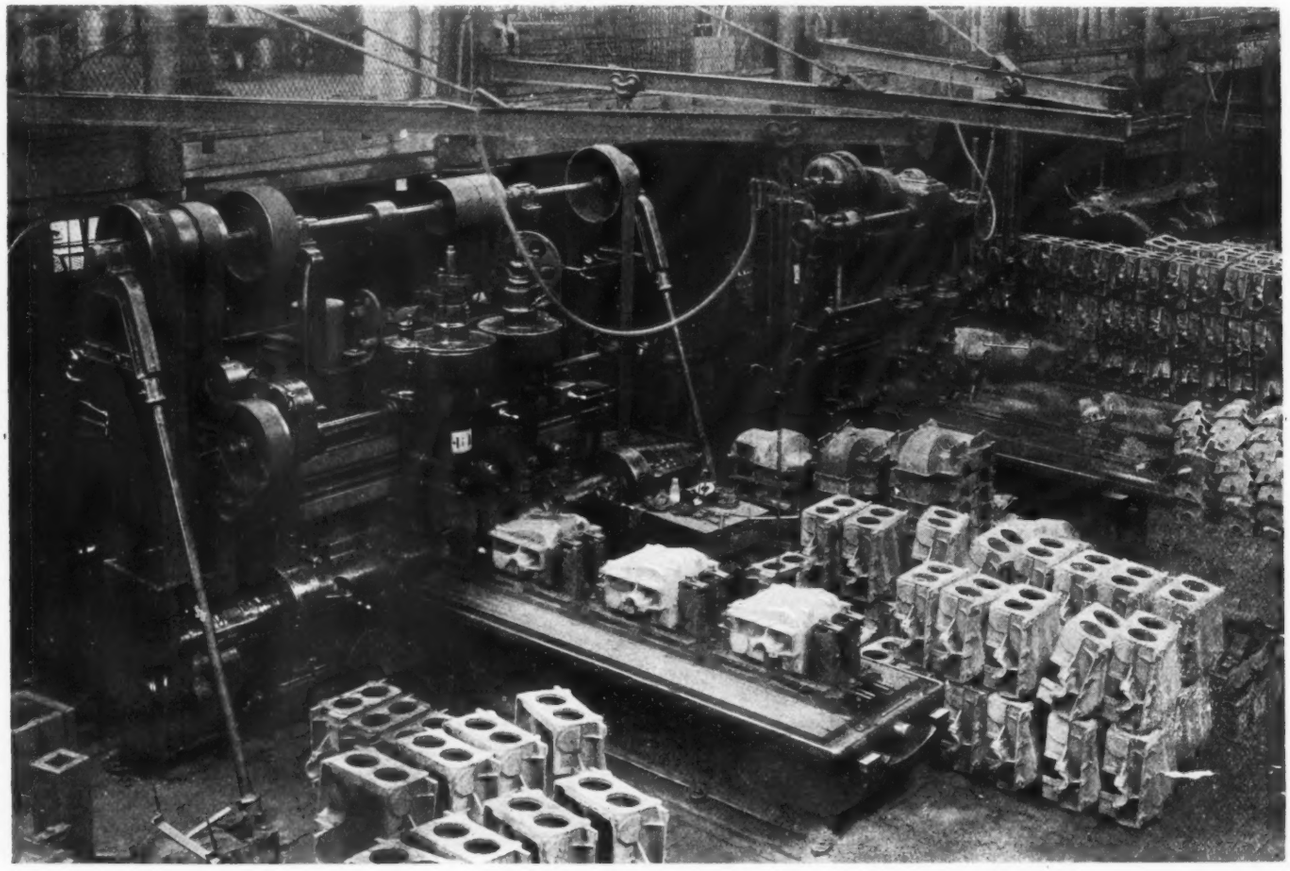
The cylinder blocks are bored and reamed, and the upper edge of the cylinder bore is beveled out so that the piston and rings will enter readily. This operation, performed in a double spindle vertical boring mill, is shown in one of the illustrations. All cylinder and cylinder head castings are given a water pressure test. The water enters the casting through a hose at the bottom; then air under a pressure of 120 lb. to the square inch is applied through a hose at the top. This method has the advantage that one test suffices to show any leakage through either the inside or the outside wall. The cylinder head flange holes are drilled in a multiple spindle drill with 11 spindles. This drill is also provided with a turntable, so that it can be loaded and worked at the same time. The drills are self-feeding, and the operator can devote all his attention to the loading of the fixture. A similar plan is used in drilling the crankcase, this being performed in two operations, four holes being drilled in the first, and five holes in the second operation in the same drill. The holes in the sides of the crankcase are drilled and tapped in single spindle drills.

In one of the galleries of the machine shop, the transmission bearings are babbitted and broached. This broaching operation includes a compacting operation, an arbor with a very small taper being forced through the babbitted bearings. Oil grooves are provided for in the arbor, and do not have to be cut specially. This compacting arbor compacts and smooths the surface of the bearing and imparts to it greater wearing qualities. The arbor is split lengthwise, at a slight angle, so that there is no difficuly in withdrawing it from the bearing after the operation is completed.

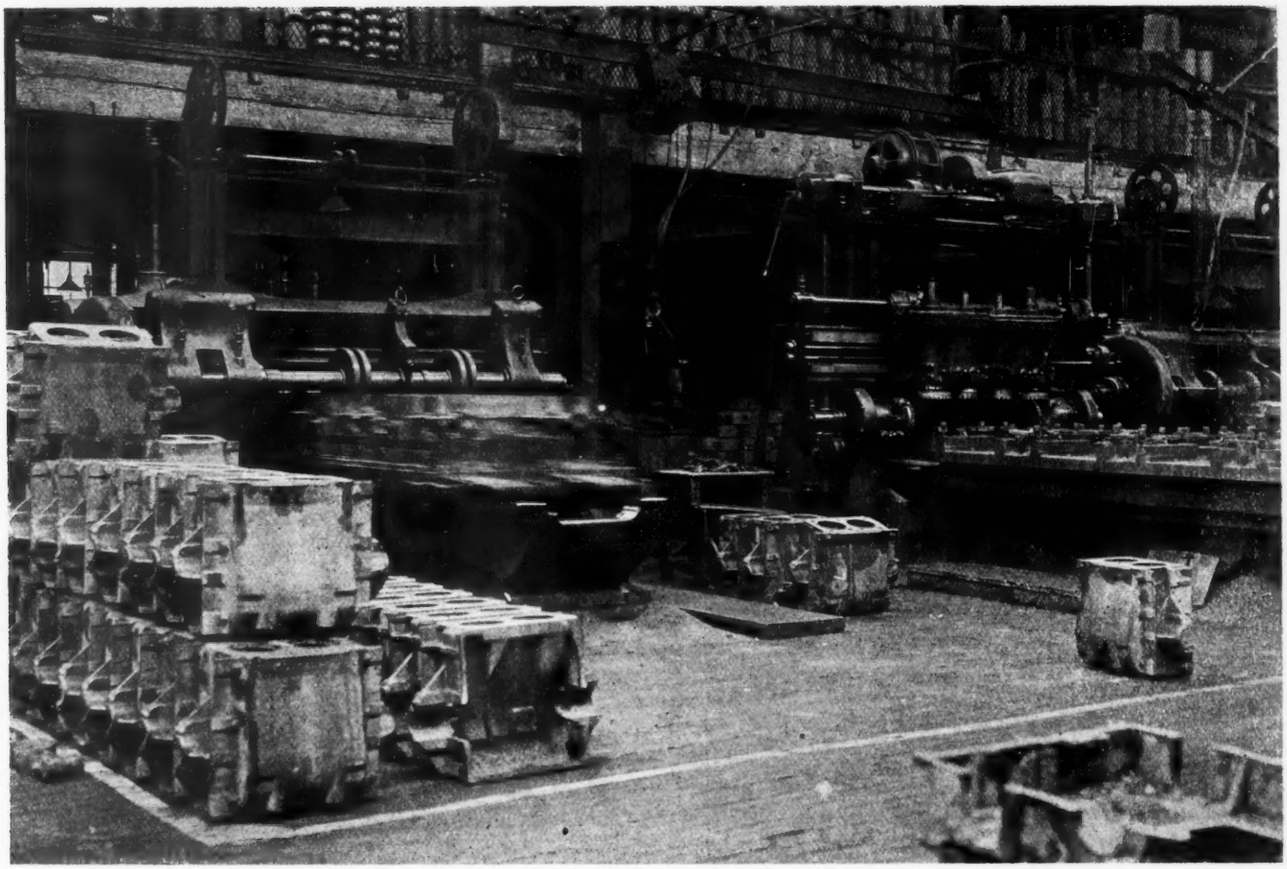
The Brass Foundry

The plant also has a brass foundry, although not a great many brass castings are used in tractors. All brass shavings are recovered in a separator, which works on the magnetic principle. The shavings are fed on to an inclined shaker, over which is passed a revolving multiple electromagnet. As the magnets pass over the shaker, at a short distance, they pick up all magnetic shavings (iron and steel) and carry them along, and as soon as they are beyond the shaker, they are demagnetized and then drop the magnetic shavings into a collector.

In the carbonizing room there are 23 furnaces for carbonizing such parts as the small sprocket, camshaft, valve push rods, cam rollers and valve rods. The connecting-rod bolts, which are made of special material, are heated in a barrel furnace for heat treatment. A recording pyrometer is in-



The cylinder blocks are milled off at both ends and at the top in one setting in an Ingersoll continuous milling machine



Both sides of the crankcase are face-ground on a diamond face milling machine

stalled in the foreman's office, and records the temperature of everyone of the furnaces, being automatically switched into circuit with the thermo-couples of the different furnaces, at intervals of one minute. This pyrometer, as stated, is of the recording type, and the records from it are sent to the assistant superintendent every day. The record is burned into the record sheet by means of electric sparks, passing from the point of the indicator arm to the drum on which the record sheet is mounted. All furnaces in the works are heated by crude oil. It should also be pointed out that all of the heavy machine tools are driven by independent electric motors.

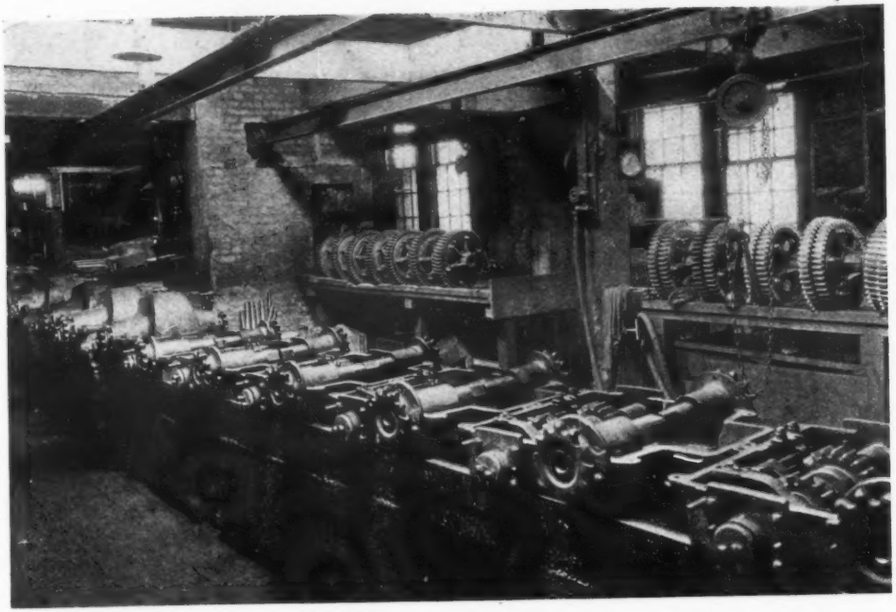
In the assembling department the so-called progressive system is used. First the frame, which is made of steel channels that are bent to form while at a red heat, are assembled with the rear axle housing and the front bolster in a jig, and riveted together. The use of this jig insures that the frame will be square. Next, the frames are placed on three caster wheels, which facilitate their movement over the floor. Each unit is brought assembled to the main line of assembly. A good example of the assembly of components is furnished by the transmission, which is assembled on the progressive plan. The transmission cases are slid along a pair of rails, at a convenient height above the floor for the workman to work upon. The low and high speed ring gears and the differential gear have been assembled previously, and come to the transmission assembly line in the form of a complete unit. An overhead monorail over the differential assembling bench delivers these units to the transmission assembly line and also serves to move the complete transmission to the main line of assembly.

The first part of the assembling work is done in what is referred to as the truck shed. When the tractor frame leaves this shed, the transmission, rear axle, gear shift mechanism and part of the steering gear (the worm and sector) are in place. In the next building, which is the main assembling room, the crankcase is put on and then the crankcase bearings are put in place. These bearings are given a double reaming, which is done by means of air tools. On a side line, oil rings and the counterweights are put on the crankshaft and the crankshafts are balanced. Then on the main line the crankshafts are put into the engine. The next assembling operation is to put on the clutch, clutch wheel and flywheel. Each end of the crankshaft is center-drilled and screw threaded, and these screw threads serve as an anchorage in forcing the flywheel and clutch onto the crankshaft. All of the heavier operations and many of the lighter ones in the assembly are performed by means of air tools. This greatly expedites the work, and obviates fatigue of the workman. Next, the keys are fitted, and the gear shields for the countershaft put on. The next operation consists in putting the cylinders onto the crankcase, the studs having been put into the cylinder block on a side line. All studs are put in place by means of air tools. A jig is used for centering the cylinders with the crank pins, the cylinder flange holes being made slightly larger to permit of this adjustment.

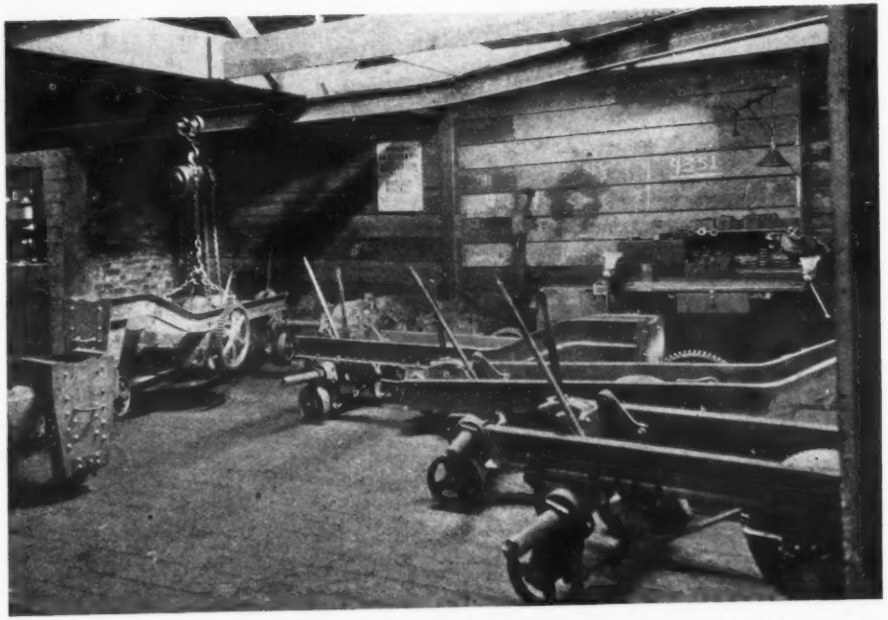
Assembling Piston Rings and Connecting-Rods

On a side bench the piston rings are put on the pistons and the connecting-rods are put in. These complete assemblies of pistons and rods are brought up to the main line at the proper place, where they go on to the chassis. Next, the oiler and oil leads are put on. The cylinder heads, with the valves, tappet arms and studs, are assembled at a side bench, and at the same point on the main line are put on to the engine. Next, the muffler is put on. At this point, the engine is subjected to a low pressure water test (30-40 lb. per square inch) to test the water tightness of the gasket.

All operations described so far are performed on a side aisle under the balcony. The chassis now having reached the end of this aisle, is turned around and enters the main aisle, and here is moved along by an overhead crane. Through the main aisle the chassis move in three parallel lines. Here the crankcase covers, with the governor, camshaft, push rods and guides, which have been assembled on another bench, are

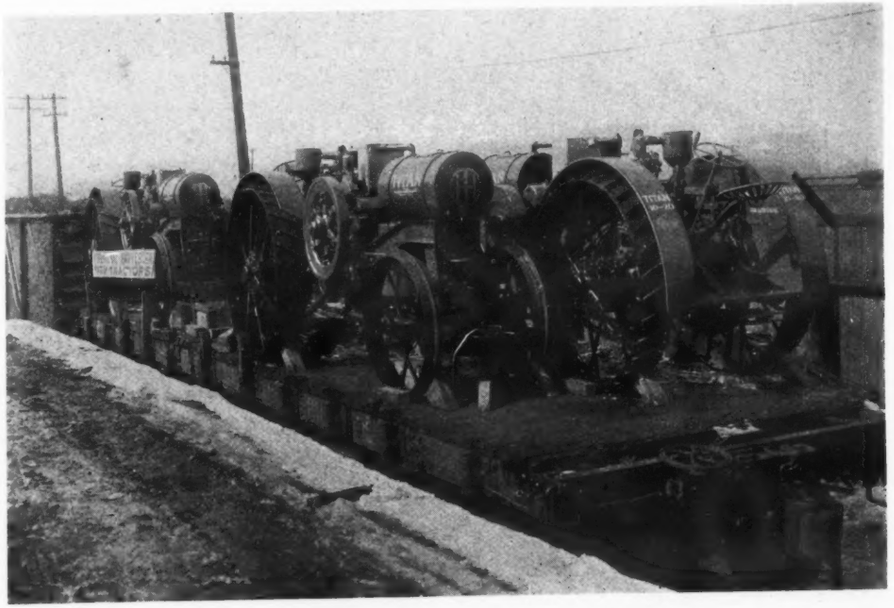


Transmissions are progressively assembled on rails, the finished product passing to the main assembly room

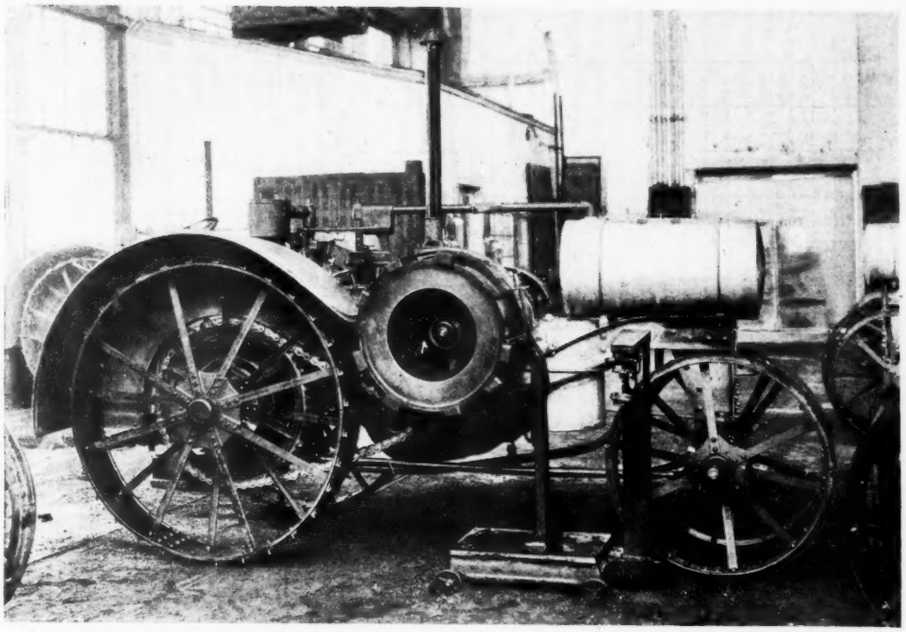


Frames with transmission and rear axle housing are assembled in a wheeled jig

General view, showing stock of finished tractors



Method of blocking flat car shipments of tractors



After final inspection the engine is submitted to a Prony brake test and operated at 500 r.p.m. under various loads for 30 min.

put on to the engine. The crankcase covers are assembled in one of the galleries, and are brought down on trucks on an elevator. At this point also the valves are timed and the magneto is set. While this is being done, other minor parts are added, such as the seat and spring, steering wheel, mixer, fuel tank and piping, governor rod and bracket, air cleaner, air pipe and water piping. All these parts are stacked up at the side of the main line of assembly opposite the particular point where they go on to the chassis.

When all these parts have been fitted, the mounting gang takes hold. They put on the front wheels, the front axle, the driving chains and steering rod, all at the same point. Then another gang puts on the water tank and connections. At the same time that the wheel shields are put on, the engine is being filled with kerosene, oil and grease. The water is delivered to the tank through a hose, which depends from a water box mounted overhead. This box is fitted with a flushing valve and all the operator has to do is to insert the end of the hose into the filling hole of the tank, pull a line connected to the valve, and the proper amount of water to fill the system will be released. The grease reservoirs are filled by means of hand grease guns, and fuel is pumped into the fuel tank by means of a measuring fuel pump.

This completes the assembly operations, and a man from the test floor now takes charge of the tractor. He primes the engine with motor spirit, and starts it with a hand crank, which operation usually succeeds at one of the first trials. Then the tractor is driven across the yard to the test floor under its own power. As more than a hundred tractors are turned out every working day, this performance is repeated every six minutes.

On the testing floor the engine is first given a 1½ to 2 hr. idling test, to limber up its moving parts. At the end of this test the connecting-rod bearing caps are removed and the bearings are inspected to make sure that they are in perfect condition. Also, the valve timing is checked over and the magneto timing and wiring is inspected. The mixer is looked over to see that its valve is set properly.

Next the engine is submitted to a Prony brake test, the ordinary water-cooled Prony brake being used. The engine is started up and its speed adjusted to 500 r.p.m., after which it is given a 30 min. variable load test. Having satisfactorily withstood this test, it is run for an hour under 20 per cent overload. After this period, the engine is given a final inspection by the test floor foreman. He removes the crankcase cover, and feels the bearings to detect any possible overheating. The tractor having satisfactorily passed this final test, it is delivered to the paint shop.

There are about 50 tractors under test at the same time on the test floor, and each tractor remains in this department for about 8 hr.

Painting is done entirely by hand, and each tractor is given two coats. As soon as the paint is dry, the tractors are loaded on platform cars or put into storage. They are driven onto the cars under their own power.

Box Handles of Webbing Save Space

IN export shipment, boxes loaded with 200 to 300 pounds are most easily manipulated when provided with handles. Usually such box handles are made of rope, inserted through holes in the ends of the box and secured with wall knots, or inserted in grooves on the under sides of the cleats on the ends of the box and held in place by nails or screws driven through the cleats.

A box handle made of webbing instead of rope has been suggested by the Forest Products Laboratory as a means of conserving space. For this purpose webbing about ⅛ in. thick and 1⅛ in. wide, which has a breaking strength of 800 lb., should prove suitable.

Battery of Cincinnati gear-cutting machines

SHOP "A" PRODUCTION SHEET

DAILY PROGRESS—MONTH OF MARCH-1919

PART NO.	NAME or PART	NO. REQ'D PER MONTH	NO. REQ'D DAILY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
5004	TRANS.-CLUTCH HAND HOLE COVER 6291			702		702	702	702	702	702	702	61	702	702	702																			
5006	DIFF. HAND HOLE COVER 6112	1000	43	21 / 0		64 / 0	107 / 910	150 / 1734	193 / 1734	236 / 1734	257 / 1734	0 / 7	300 / 1734	343 / 1734	386 / 1734	429	472	493		536	579	622	655	708	729		772	815	858	901	944	965		1000
5008	PILOT BUSHING 11164	1000	43	21 / 0		64 / 0	107 / 0	150 / 0	193 / 0	236 / 0	257 / 0		300 / 0	343 / 0	386 / 0	429	472	493		536	579	622	655	708	729		772	815	858	901	944	965		1000
5016	TRANS BEARING PLATE					156	276	276	276	276	276																							
5032	CLUTCH SHAFT 1348	2911	123	62 / 8		185 / 26	308 / 35	431 / 36	554 / 36	677 / 207	739 / 285	1	862 / 295	985 / 401	1108 / 516	1231	1354	1416		1539	1662	1785	1905	2013	2043		2216	2339	2462	2585	2708	2770		2900
5033	CLUTCH SHIFTER BRACKET 4273										8		8	8	8																			
5035	CLUTCH SHIFTER 6871			2		3	3	3	3	3	3		3	3	3																			
5036	CLUTCH LEVER INNER 9620			0		1115	1915	1915	1915	1915	1915	1 / 4	1915	1915	1926																			
5037	CLUTCH LEVER OUTER 5410			0		765	1860	3040	3040	5218	5218	4	5218	5278	5298																			
5044	CLUTCH SHIFTER LINK SHANK 3522	500	21	12 / 8		33 / 0	54 / 0	75 / 0	96 / 0	117 / 0	129 / 0		150 / 0	171 / 0	192 / 0	213	234	246		267	288	309	330	351	363		384	405	426	447	468	480		500
5046	CLUTCH ANCHOR PIN			95		95	1464	1404	1404	1404	1404		1404	1404	1404																			
5051	GEAR SHIFTER SHAFT 4413	4100	174	87 / 0		261 / 25	435 / 821	609 / 821	783 / 821	957 / 821	1044 / 821		1218 / 822	1392 / 822	1566 / 822	1740	1914	2001		2175	2349	2523	2697	2871	2958		3132	3306	3480	3654	3828	3915		4100
5052	GEAR AND CLUTCH SHIFTER BUSHING 6093	2100	89	45 / 1077		134 / 407	223 / 923	312 / 925	401 / 925	490 / 925	535 / 925	14	624 / 971	713 / 971	802 / 472	891	980	1025		1114	1203	1293	1381	1470	1515		1604	1693	1782	1871	1960	2005		2100
5053	GEAR AND DIFF. LOCK SHIFTER 98	7900	336			504 / 295	840 / 810	1176 / 811	1512 / 811	1848 / 811	2016 / 1293	1 / 1	2352 / 1295	2688 / 1295	3024 / 1295	3360	3696	3864		4200	4536	4872	5208	5544			6048	6384	6720	7056	7392	7560		7900
5054	GEAR AND DIFF. LOCK LOCKING PLUNGER					134 / 1077	223 / 1077	312 / 1077	401 / 2601	490 / 2601	535 / 2601	11	624 / 3341	713 / 3341	802 / 3341	891	980	1025		1114	1203	1293	1381	1470	1515		1604	1693	1782	1871	1960	2005		2100
5090	GEAR SHIFTER LEVER 3821						2	2	2	2	2	12 / 235	2	2	26																			
5092	GEAR SHIFTER SHOE 5815	2100	89									8 / 240																						
5093	9/16" X 9/16" X 7/8" KEY																																	
5096	DIFF. THRUST ADJUSTER 7832			3	500W	113	579	885	1154	1154	1154	118	1154	1154	1154																			
5101	DIFF. SHAFT R.H. 5409	500	21	12 / 230		33 / 234	54 / 521	75 / 615	91 / 747	117 / 747	2	130 / 909	171 / 1080	192 / 1081	213 / 532	234	246	267		267	288	309	330	351	363		374	405	426	447	468	480		500
5102	DIFF. SHAFT L.H. 3494	1400	59	30 / 0		89 / 0	148 / 0	202 / 0	266 / 0	325 / 0	355 / 0	2	414 / 0	473 / 0	552 / 0	511	650	[illegible]		734	798	857	966	975	1005		1064	1123	1182	1241	1300	1330		1400
5103	BULL PINION SPACER 15267											98																						
5104	DIFF. LOCK SHIFTER LEVER 3972						1	1	1	1474	1474	6 / 4	1474	1856	1860																			
5127	DIFF. LOCK CONTROL ARM 4890			10		10	14	10	10	10	10	121	10	10	10																			
5128	DIFF. LOCK SHIFTER PIN 18863											91																						
5131	DIFF. LOCK SHIFTER SHAFT 3706	800	34	17 / 0		51 / 0	85 / 0	119 / 0	153 / 0	187 / 0	204 / 0	102	238 / 6	272 / 6	306 / 6	340	374	391		425	459	493	527	561	578		612	646	680	714	748			800
5141	AXLE HOUSING END R.H.																																	
5144	AXLE HOUSING END L.H.																																	
5145	BRAKE HUB 2911	500	21	12 / 9	1464W / 1570W	33 / 9	54 / 1277	75 / 1979	96 / 2444	117 / 2444	134 / 2444	1	150 / 2661	171 / 2661	192 / 2461	213	234	246		267	288	309	330	351	363		384	405	426	447	468	480		500
5146	BRAKE SHOE ANCHOR 3818	4400	187	94 / 279		281 / 279	468 / 647	655 / 870	842 / 1018	1	1123 / 1028		1310 / 1028	1497 / 1140	1684 / 1294	1871	2058	2152		2339	2526	2713	2900	3087	3181		3368	3555	3742	3927	4116	4210		4400
5147	BRAKE CAM R.H. 19046					4830	4870	4830	4830	4830	4830	15 / 181	4830	4830	5026																			
5148	BRAKE CAM L.H. 2352	800	34	17 / 0		57 / 0	85 / 377	119 / 377	153 / 377	187 / 377	204 / 377	53 / 61	238 / 373	272 / 377	306 / 377	340	374	391		425	459	493	527	561	578		612	646	680	714	748	765		800
5149	BRAKE CAM LEVER 1847	1800	77	38 / 0		115 / 721	192 / 1163	269 / 1063	346 / 1063	423 / 1063	451 / 1063	307 / 63	538 / 1063	615 / 1063	692 / 1063	769	846	884		961	1038	1115	1192	1269	1307		1384	1461	1538	1615	1692	1730		800
5150	BRAKE SHAFT 13664			2		2	2	2	2	2	2	13	2	2	30																			
5165	BRAKE BALL ARM 10007											7																						
5195	ADJUSTING ARM PAWL 4632									485	485	129	485	485	485																			
5188	ADJUSTING ARM GIB 2586	1600	68	34 / 0		102 / 0	170 / 0	238 / 0	306 / 0	374 / 0	408 / 0	34 / 76	476 / 0	544 / 0	612 / 2	680	748	782		850	[illegible]	986	1054	1122	1156		1224	1292	1360	1428	1496	1530		1600
5206	GAS TANK BRACKET FRONT 2163	1000	43	21 / 0		64 / 0	107 / 0	150 / 0	193 / 0	236 / 0	257 / 0	3	300 / 0	343 / 638	386 / 1425	429	472	493		536	579	622	655	708	729		772	815	858	901	944	965		1000
5215	GAS TANK BRACKET REAR 5068			0		163	163	543	543	543	543	9	543	543	726																			
5227	GAS TANK STRAP BOLT 4212			433		1147	1163	1163	1163	1408	1490		1871	1871	1871																			
5249	BEVEL PINION SHAFT COLLAR 1792	2300	98	49 / 0		147 / 0	245 / 0	343 / 0	441 / 0	5	588 / 719		686 / 719	784	882	980	1078	1127		1225	1323	1421	1519	1617	1666		1764	1862	1960	2058	2156	2205		2300
5251	REVERSE SHAFT 12835			1544		1544	1544	1544	1544	1544	1544	83 / 22	1544	1544	2163																			
5252	STEERING YOKE PIN 11889					1411	1411	1411	1411	1411	1411	90	1411	1411	1411																			
5254	CLUTCH SHIFTER LEVER 3613											111																						
5255	CONTROL CROSS MEMBER 6	800	34	17 / 0		51 / 0	85 / 0	119 / 0	153 / 0	187 / 0	204 / 0	602	238 / 0	272 / 0	306 / 0	340	374	391		425	459	493	527	561	578		612	646	680	714	748	765		800
5256	STEERING SUPPORT LOCK 6096											102																						
5257	BRAKE LEVER 5469											1 / 4																						
5258	HAND LEVER BUSHING 10076											0 / 5																						
5259	CONTROL LEVER BRACKET 2467	7500	64	32 / 243		96 / 243	160 / 243	224 / 587	288 / 1236	352 / 1602	384		448 / 1678	512 / 1678	576 / 1678	640	704	736		800	848	864	928	992	1056		1152	1216	1280	1344	1408	1440		1500
5262	CLUTCH/HAND SHIFT LEVER 52098											298																						
5263	GEAR SHIFTER LEVER GUIDE 7127			2		2	2	2				1 / 6	358 / 2																					
5264	GEAR SHIFTER LEVER GUIDE SEPARATOR 2862	1300	51	26 / 0		77 / 0	128 / 0	179 / 0	230 / 565	281 / 1137	302 / 1149		357 / 2264	408 / 3322	460 / 4022	511	562	588		639	690	741	792	843	869		920	971	1022	1073	1124	1150		1200
5268	ROD END PIN 5746	3000	128	64 / 0		192 / 0	320 / 0	448 / 0	576 / 0	704 / 0	768 / 0		896 / 1426	1024 / 1476	1152 / 1426	1280	1408	1477		1600	1728	1856	1984	2112	2176		2304	2432	2560	2688	2816	2880		3000
5270	LEVER CONTROL ROD END REAR 16921											226																						
5271	GEAR SHIFT HAND LEVER 18412			9800		9800	14800	14800	14800	14800	14800	511	14800	14800	14800																			
[illegible]	CONTROL LINK ROD END REAR [illegible]																																	

A New Shop Accounting System

As Installed by the Tractor Branch of the Moline Plow Co.—Gives at All Times a Correct Record of the Situation in the Plant with Respect to Raw Materials and Finished Parts

IN order that a production schedule may run ahead smoothly, it is necessary that all parts required for the complete product, whether manufactured directly in the plant or obtained from outside sources, be always kept on hand in sufficient quantity to allow of assembling work going on unhindered. To insure this regular supply of parts, most large plants have a stock accounting or stock chasing department, the duty of which is to keep an accurate record of the stocks of all parts on hand and to issue a warning when the supply of any one part runs low. A special system for accomplishing this object has been worked out and applied by the tractor branch of the Moline Plow Co. and has proved most satisfactory.

Each department is provided with a schedule which covers the various items on which that department does any work, showing what quantity it is necessary to produce each day. These schedules are made up a whole month in advance. As the parts are produced, the production figures are posted on the schedule. When production of a part is up to or runs ahead of the schedule, the figures are posted in black, otherwise they are posted in red ink. Figures regarding parts that are not made in the factory, but obtained from outside sources are posted from the receiving slips made out when the parts come in.

The master sheets are kept in the Production Department, but duplicates of the sheets are sent to the respective factory departments. There are six departments for which duplicate sheets are made out, namely:

1. Purchasing department.
2. Foundry.
3. Forge shop.
4. Grinding and snagging.
5. Machine shop A.
6. Machine shop B.

A master sheet is made out for each depai tment. Each of these sheets contains columns for the parts, numbers and names of all parts which the particular department handles.

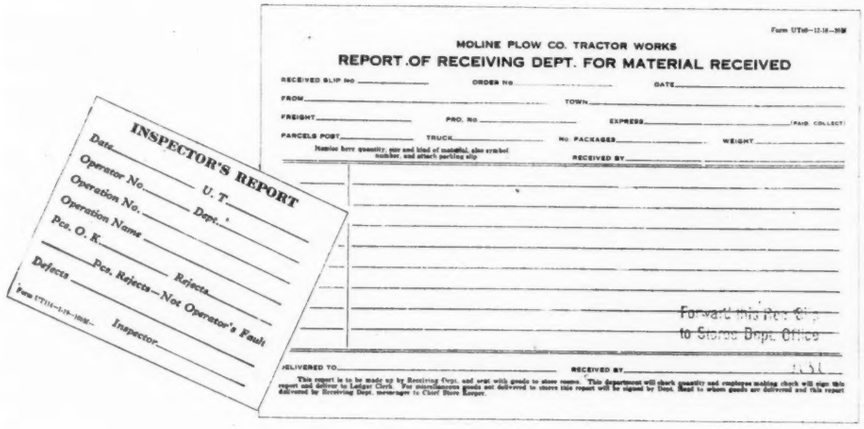
Then follows a column in which are entered the numbers of parts required per month, and then another column in which the numbers required per day are entered. At the beginning of the month there are entered upon the sheets the numbers of all parts on hand, the total numbers required for the month, and the requirements per day, the latter figures being extended across the sheet. Production data are entered upon the sheet in cumulative figures, in black or red, according to whether production runs ahead or behind schedule.

The product of each department goes through the hands of inspectors, and all inspectors make a daily report to the Production Department. One of these inspector's blanks is shown herewith. Red and blue buttons are used to indicate a dangerous shortage in the amount of stock on hand, which is figured in terms of number of days' supply. When the stock of any particular part runs low, a red button is placed on the sheet to indicate the day on which the supply, if not replenished, would run out. Blue buttons are used when the supply of parts runs low, but will last into the following month, in which case it is necessary to post the button in one of the first columns of the sheet. The blue button really indicates that the date to which the supply on hand lasts is in the following month. When new stock is received, the buttons are moved. One man does all the posting, and spends only about one-half of his time at it.

Weekly Check Up of Scrapped Material

At the end of every week, pieces that have been scrapped and parts that have been sent out for repairs are checked off. At the end of every month the man having charge of the accounting system takes the stock on hand at the beginning of the month, adds the number of parts produced during the month, subtracts the number of parts used in manufacturing operations, the number of parts scrapped, and the number of parts sent out for repair purposes, and the remainder is the stock on hand at the beginning of the next month.

The schedule here described acts as a shop order, and also as a stock record. The Moline Plow Co., in its tractor department, issues no special shop orders for any parts manufactured in its own plant, the schedule of the Production Department serving this purpose.



Sources of Production Sheet Data

The form herewith serves for collecting the data which are entered on the production sheets. All product completed by any department of the works passes through the hands of inspectors and the inspectors' reports are sent to the production department. Similarly when material purchased by the company arrives at the factory it is checked up by the receiving department and the report made out is sent to the production department.

Airplane view of Motor Reconstruction Park

M. T. C. Salvage Park in France

PART I.

An American War Factory in the Heart of France—3500 Employees—Built in 65 Days—Was 120 Miles Behind Front —Engine Department Overhauls 100 Engines Per Week —1000 Jobs Weekly Output—Manufactures New Parts

By W. F. Bradley*

PARIS, Feb. 11—Early in May, 1918, a staff of Motor Transport Corps, U. S. A., officers and mechanics was put in possession of 337 acres of agricultural land in the center of France and told to erect on it a main salvage and reconstruction park capable of taking care of all the wreckage then accumulated from the front, and to provide for the huge quantity bound to come with the summer fighting.

The first task of the M. T. C. men was to drive the cows off the land, then to erect buildings, and, as each one was completed, to appoint a staff and start production. The ground was purely pastoral. A railroad ran through it, and the nearest village comprised a score of houses. The 3500 men put on this job brought all the material, with the exception of some lime and stone. They prepared their own plans. They cleared and drained the land. They erected the buildings and installed machinery, and on July 15, or only 67 days after taking possession of the bare land, moved into the shops. Fifteen days later they were in production.

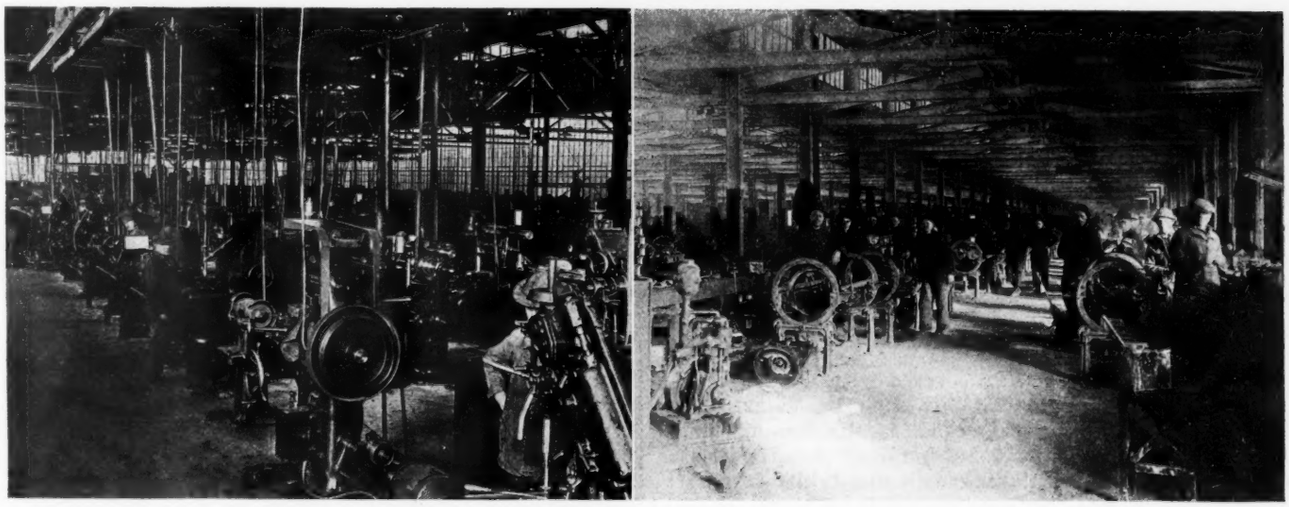
Editor's Note—W. F Bradley has studied motor transport during the war in France, Belgium and Italy and has been associated with this department of war since 1914. He assisted in the purchase of many automobiles and trucks for the A. E. F. in the summer of 1917 and personally superintended the overland delivery of many Fiat vehicles for our army. He made a minute investigation of the Salvage Park described in this article.

5300 Busy Workers

When I visited this reconstruction park in November, 1918, there were 3500 skilled mechanics at work in the shops and a gang of 1800 German prisoners and civilians doing such general work as making roads, laying foundations for buildings, unloading freight cars, etc. The whole organization had grown so fast that outsiders had not had time to marvel at it. Paris had not heard of its existence. Other branches of the army knew in a vague sort of a way that a reconstruction park was being erected and assumed that it was still in the erection stage.

There has been a lot of quick work done by the American Army in France, but it is doubtful if there is anything to equal this job of erecting an automobile reconstruction park to employ 3500 men, and having those men working at their own trades within 4 months of breaking ground. And these M. T. C. mechanics did not

Main street at Motor Reconstruction Park. On right are offices and stockroom; on left are machine shops



Left—Tool room at Motor Reconstruction Park. Right—Engine repair shop with 86 engine stands; 100 engines completely overhauled every week

A line of trucks to be salvaged by Motor Reconstruction Park

apply to the Engineers Corps for assistance, nor did they requisition for labor battalions. Being practically all skilled workers from the automobile factories in the United States, they estimated that they were capable of erecting buildings, laying foundations, and installing machinery as efficiently as any bricklayers or masons. And they did it. It was not until after they had enough buildings up to enable all of them to be employed at the jobs for which they were specially skilled that they were given prisoner and civilian help for the rougher work.

The scope of this reconstruction park is to receive all the wreckage from the front, and to repair or salvage it, according to its condition; also it has to act as main supply depot for the Motor Transport Corps of the A. E. F. It has to cover all vehicles, with the exception of foreign makes, which go to a special park; and in addition to motor equipment it has to take care of all such Quartermaster horse-drawn vehicles as field kitchens, wagons, etc.

The Wreckage of War

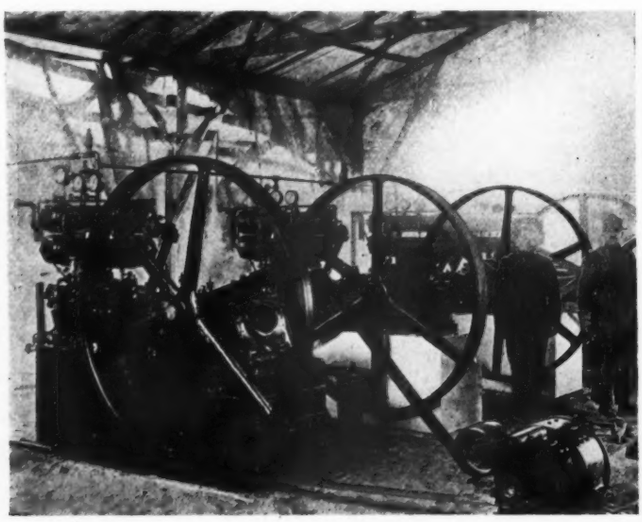
Up at the front, 120 miles away, they collected everything on wheels which they were unable to repair, loaded them on freight cars, and dumped them by the train load in the grounds of the reconstruction park. When the front was quiet there was a steady stream of vehicles which had broken down in service, or which had been damaged in accident. But after every big battle there came a mad torrent of almost indescribable wreckage.

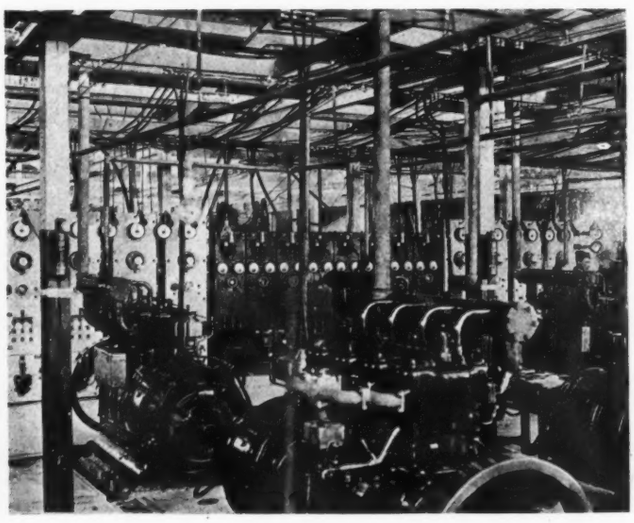
Looking it over, the question which naturally arose was, "How is it possible for automobiles to get into such a condition?" If a gang of ruffians had been put in possession of several hundred automobiles and told to wreck them so that they would look as unlike automobiles as possible, it does not seem conceivable that they would have succeeded in getting anywhere near the wrecking perfection attained by war.

They were all war wrecks covered with a thick coating of yellow, French mud. With some the story could be traced, as for instance the Cadillac limousine which had been in the direct line of a bursting shrapnel shell, and which had been sent back with blood, bits of flesh, remnants of uniform and equipment intermingled with its torn upholstery and horsehair stuffing. A few weeks later that car went out practically new, and the men who are riding in it at this moment undoubtedly are unaware of the grim tragedy attached to it.

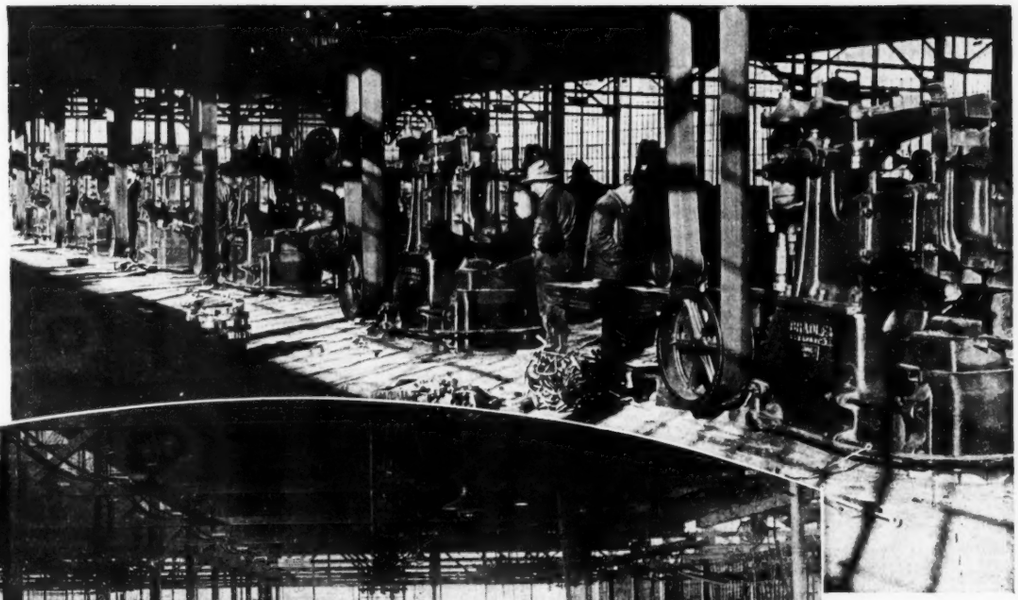
As there was no time to prepare the ground, a Holt tractor had to be used to haul damaged trucks inside the park

German prisoners stacking salvage motorcycle parts

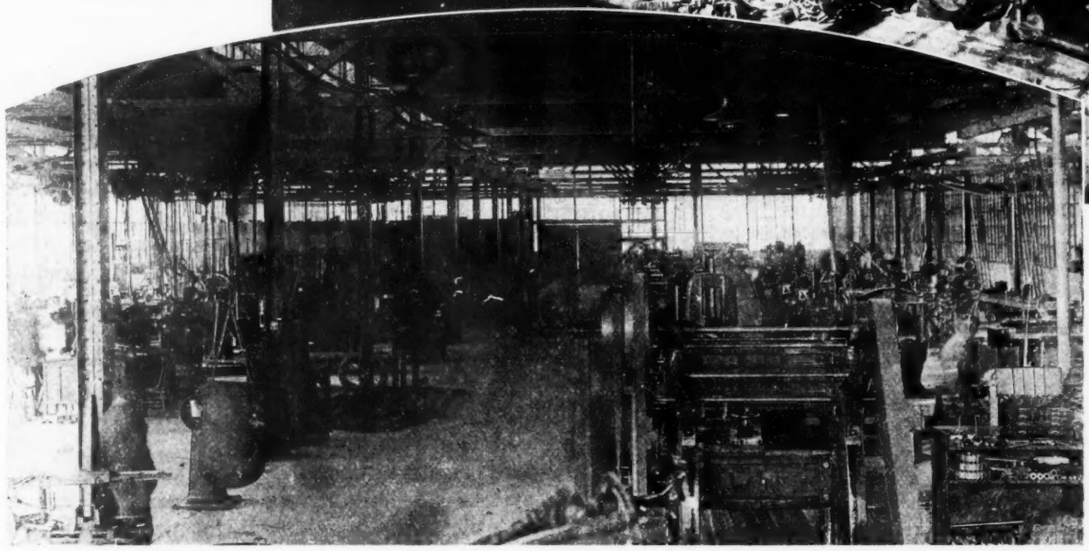




Left—Gas compressors at Motor Reconstruction Park. Right—Part of power plant. White steam engine being installed. Gasoline-electric groups developing 700 hp. are made use of



One line of the 14 Bradley hammers in Motor Reconstruction Park



One of the four machine shops

How a six-cylinder Mercedes aviation engine, complete with radiator, instruments and some of the fuselage, found its way into a wrecked American truck and was then dumped off into the mud of the reconstruction park, nobody ever will know. But the mechanics accepted it without asking any questions, stripped it, relined the bearings, repaired the pierced intake manifold, which had been the original cause of its capture, and soon had it in running condition.

It takes the better part of a day to completely travel over the whole of the motor reconstruction park, of which Colonel H. A. Hegeman is the commanding officer and of which Major J. A. Hickey is the master mechanic. The main office, right in the center of the camp, is an Austin type building 100 by 140 ft., with modern office furniture, a telephone on every desk, and the commanding officer accessibly placed at the head of the building, with the whole of the service under his direct supervision. This American method of placing the chief in the same buildings as his assistants, accessible to every visitor, is an unfailing surprise to the French, who have been taught that a leader's importance is measured by the number of doors separating him from his subordinates.

Of the 337 acres of ground given over to the reconstruction park, 207 had been covered between May 8 and Nov. 1, and the floor space of the shops comprised 485,300 sq. ft. Most of the buildings are of the Austin type, of steel construction, with a small amount of brick. Generally they are 100 by 260 ft. In addition to a number of others of different type, four of these Austin buildings had been erected and were in full operation early in November. The first one was a metal working shop, given over to the repairing of tanks, radiators, gasoline drums, etc. The following, and similar sized building, was a machine shop, fully equipped with modern machinery for all kinds of work. The third building in line was a machine shop with a thoroughly up-to-date tool room. The fourth was the forge, having among other equipment ten Bradley drop hammers and a modern spring making department, controlled by a specialist from Detroit, who produced from 40 to 60 sets of springs per day.

The main engine shop is of different structure, being a long building 639 by 96 ft., with seven bays, each 240 by 50 ft. This shop has 72 engine stands and 14 special Ford stands. It completely overhauls 90 to 108 engines per week. The wood-working department comprises two main buildings, each 100 by 260 ft., fitted with power-driven saws, planers, mortising machines, etc., and used specially for rebuilding horse-drawn vehicles. Adjoining are separate buildings for automobile upholstery, leather work, tops, hood covers. There are completely equipped shops for battery work, for electrical appliances, and for magnetos.

Most of the acetylene, oxygen and hydrogen required by the M. T. C. is produced at the reconstruction park and sent out from there. The plant, at the time of my visit, was filling 60 big acetylene bottles and 69 motorcycle acetylene bottles per day. In the hydrogen and oxygen department 80 of the former and 40 of the latter bottles were being filled, each bottle having a capacity of 200 ft. The compressors were under cover, but the gas lines were led out of doors, so that the actual filling was carried out in the open air. The filling of the motorcycle acetylene bottles was done under water.

(To be continued)

AUTOMOTIVE INDUSTRIES
The Automobile

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Buying Uncertainty

RARELY has there been such a wary attitude on the part of purchasing agents in going ahead with their inventories for the coming year as there is at present. At this season of the year the material for summer production is generally well in hand, but this year the purchasing agents are not buying more than a month or two ahead, except in very particular instances where the market conditions appear particularly favorable. One of the main reasons for this is the inability of the purchasing agent to accurately gage whether or not there will be a further drop in steel prices. The slowness of the Government in making adjustments on contracts is another factor, and there is no doubt that the continued control of the railroads by the Government is also having an effect, as this has influenced to some extent the release of purchase orders for steel by the railroads.

The practice of "hand to mouth" buying is disturbing and expensive. The cost of handling small orders is almost as great as that of handling larger ones, with the resulting tendency to keep costs up. It is about time that stabilized conditions were reestablished in the industries, and if purchasing agents generally will gather a little more confidence in the situation and act on their beliefs that prices cannot come down materially for some months, it will at once relieve the situation.

Uncertain conditions are not confined to the automotive industry, but obtain in all industries, and the inter-locking relationships of different industries make the uncertainty in the purchasing field of a contagious nature. Once the field goes ahead on its knowledge that material prices are not apt to change radically during the next few weeks, it will have a marked stabilizing effect on business in general.

Since there are no signs at the present time that wages will be reduced, it is quite certain that all other matters are going to remain in about the same state, and reductions in the price of materials, of labor and of factory space are not to be looked for during the balance of this year. The important point is to have manufacturers realize this condition and that they should go ahead and buy for manufacture on a longer time schedule than is being done at present.

Tractor Demands

THE open winter permitting plowing with horses and thus getting away from the peak of early spring plowing, to a measure accounts for the slowing up of tractor demand on the farm, but this is not the complete explanation of the situation. The farmer is better able to purchase tractors today than at any time in his history, but he still holds back and may continue to hold back for 2 or 3 months more until he harvests the present crop.

Possibilities of lower prices are holding back many sales. The small reduction in steel prices is looked upon as but a starter, and the farmer considers himself peculiarly fortunate in being able to get by this spring without investing in a tractor and at the same time not have to reduce his crop acreage.

Too few people in the country realize that prices cannot drop to the pre-war level, but unfortunately the farmer is not one of these few. He looks too often for the price pendulum to swing back to the 1914 level, which it will never do. A little educational work by the tractor makers would accomplish a great deal in analyzing the price situation to the farmer. It would be a much more constructive and positive method of merchandizing than cutting prices.

The present offers a quite confused situation—open spring, high costs of materials, and increased production facilities with many concerns. The trouble will remain for a few months, perhaps until the present crop is harvested, after which it is difficult to see how there cannot but be a big tractor demand. The farmer may perhaps not in a generation be favored with such a set of conditions. It behoves the manufacturers not to do anything that will rock the boat.

Co-operative Plans Between Organization and Labor

CO-OPERATION is very largely psychological, whether it is between the employer and the employee or between persons occupying approximately the same business plane. You have two parties in co-operation, and if the co-operation is to be real then it must result from the united effort of both parties.

It cannot come if the plan is worked out by one of the parties and thrust on the other. That is not co-operation, but rather coercion. The plan must be one of mutual evolution.

In the labor problem many of the so-called co-operative plans have failed because they were evolved entirely by the employer. He worked out the entire plan. The workers were not consulted in it. The employer not only conceived the plan, but put it up to the workers as his plan. They had no voice in it. They were merely asked to accept it.

It did not get a favorable reception from the workers because it was thrust upon them more or less as a charity measure so far as any additional wages were concerned. As such it flavored too strongly of paternalism. It was not co-operation in the sense of two parties working to do a job better and for the improvement of the two parties on an equal basis.

It is not surprising that some workers view with suspicion such co-operative plans which have been cut and dried by the management and then thrust before the workers for speedy ratification by them. Too frequently the workers view the plan with suspicion.

Let the employer put himself in the place of the worker: Let the workers thrust into his hands a carefully worked-out plan of factory management and division of profits and then ask for the ratification of it by the management in a single day.

What management is there that would not want to refer such a document to a corps of lawyers and have it gone through from end to end to find the nigger in the fence?

After receiving such a document the employer might see that real, enduring co-operation must arise from the co-work of two parties in which each is a factor in evolving the plan. The plan must come from both sides. It must be the product of mutual conception and deliberation.

It is this psychological aspect of the worker that Charles P. Steinmetz lays special emphasis on in his address printed on another page in this issue. It is to the failure to recognize this factor that he attributes the failure of so many so-called industrial relationship movements.

The worker has been suspicious of what has come from the management because, as Dr. Steinmetz says, the trouble between capital and labor today is a historical one. It began more than a generation ago and being of such long standing cannot be corrected in a day, a week or a month.

Unfortunately, labor and capital in too many cases occupy hostile camps. Instead of working together for increased production and reduced prices with the greater profits that ensue, labor stands off in its camp and capital stands opposite in its camp.

With the higher average of educational training the employer should take a broader view of the situation than labor. If education is to be of value, this is one way in which it should exhibit itself. Breadth of view is a natural product of education.

To start the solution process and to untangle the present knot, labor must see capital take the initiative.

Capital has been the stronger and as such can the more afford to approach the subject on a real basis of co-operation. Capital must give the worker a free opportunity to discuss the plans. The worker cannot be expected at the start to have as complete a grasp of the situation as the management and will make errors. These will have to be handled carefully.

The organization will discover it has an educational work on hand that it is obligated to carry on. It will require greater investments for this work than many organizations have been accustomed to make, but the goal is deserving of the price, and we cannot afford to fall short in the attainment.

Latest News of the

Overland Refuses to Increase Wages

Employees Threaten Walkout But Have Not Done So Yet—General Labor Unrest

DETROIT, April 17—The Willys-Overland Co. has refused the demands of its employees for increases in wages amounting to from 15 to 40 per cent, but though an immediate walkout has been threatened, this has not occurred. Vice-President C. A. Earl does not believe that the men will walk out, his belief being based on the fact that on Monday the Willys-Overland Co. will make the first distribution of profits under the profit-sharing plan which it recently adopted. This will give about $200,000 to employees who have been in the service of the company for more than 6 months.

The workers definitely demanded an increase of 15 cents per hour, the demand representing a total of 12,000 workers. They also demand that piecework be abolished and the working day be shortened to 8 hours, with 4 hours Saturday, and double time for overtime work.

Willys-Overland has not reduced the war wage scale. The demand for an increase would put wages from 15 to 40 per cent ahead of this scale and, if granted, would cost the company approximately $4,000,000 annually.

General Demand for 8-Hour Day

The discontent in labor circles is not confined to the Overland plants. In and around Detroit labor is in a state of unrest, with a general demand for an 8-hour day. The workers do not want their labors reduced to 8 hours a day, but want a 9- or 10-hour day with double time for the one or two hours overtime. At the Wadsworth Mfg. Co., which is a large top maker, the day force of 300 men has walked out, demanding a general increase in wages.

There is no longer any unemployment in Detroit, the pendulum having swung the other way. It is now difficult to get skilled labor, though unskilled labor is plentiful. Skilled men are averaging 65 cents per hour and unskilled men 45 cents.

Apparently there is a stable element among the older men, who have saved money and built homes, and this is having a good influence. The general impression is that the employers will win out.

Another matter which is causing some trouble is the competition among cities for labor. Cities around Detroit resent employers in Cincinnati, Cleveland and Detroit advertising in papers in those cities for help.

—

Sinram Heads Gear Makers for Third Term

CLEVELAND, April 16—F. W. Sinram, of the Van Dorn & Dutton Co. of this city, who has been president of the American Gear Manufacturers' Association since its formation at Lakewood, N. J., two years ago, was unanimously re-elected for a third term at the annual meeting of the association held here yesterday.

—

Fordson Plant Closed for Inventory

DETROIT, April 17—The Henry Ford & Son factory plant at Dearborn has closed down for the first time in 18 months and will remain closed for 2 weeks for a general inventory. The plant has been running three 8-hour shifts daily. On Saturday there was a clean-up and 914 tractors were turned out. The normal daily production has been running about 240 to 250 tractors. To date 53,075 tractors have been completed.

—

Want Government Tractor Tests

CHICAGO, April 11—Tractor manufacturers who are members of the Tractor and Thresher Department of the National Implement & Vehicle Association, at a special meeting to-day formally expressed to the Department of Agriculture at Washington a desire that it establish a bureau to conduct tractor tests to determine draw-bar and belt-power ratings of machines and to furnish a certifictae of the findings made by the bureau on each tractor tested. It is believed that certificates of power ratings, issued by a government bureau, would be of such standing nationally and internationally as to fully satisfy all interested persons.

Under this plan a variety of tests proposed by the several state legislatures would be done away with, and a much more satisfactory uniform national rating would be applied. This would eliminate the tremendous expense of the manufacturers in having their tractors tested by each of the states and would eliminate the variety of conditions to be met under the state control in all sections of the country. With the rapidly increasing volume of export trade, the tractor manufacturers feel that a federal certificate of horsepower ratings would be more recognized by all foreign countries.

A committee of the Tractor & Thresher Department was appointed to bring this matter before the proper officials at Washington in the hopes that this very desirable legislation may be procured.

—

Repair Agencies for Trucks Sold to A. E. F.

WASHINGTON, April 15—Thirteen American truck and car manufacturers have arranged to maintain agencies in Europe to supply parts and make repairs for all vehicles sold by the A. E. F.

S. A. E. Summer Meet June 23-27

Will Combine Business and Recreation Convention at a Great Lakes Hotel

NEW YORK, April 17—The summer meeting of the Society of Automotive Engineers will be held at Ottawa Beach, an exclusive summer resort on the east shore of Lake Michigan, 6 miles from Holland. The society has secured the exclusive use of the Ottawa Beach Hotel and cottages for June 23-24-25-26 and 27. Accommodation will approximate 1000 members and guests. The Standards meeting will be held Monday, June 23. In the evening the annual business meeting will take place and on Tuesday, Wednesday, Thursday and Friday professional sessions will occupy the program. Two half days will be given over to recreation and sports.

The rule which barred ladies from attending the sessions the last 2 years during the war has been waived and members will have an opportunity of taking their families and combining a vacation with the summer meeting.

The Meetings Committee, in deciding upon the nature of the meeting, took a mail vote of over 100 members to discover the kind of meeting they desired, and the vote was overwhelmingly in favor of a convention of professional sessions and recreation. The members are anxious to have an opportunity of fraternizing with one another and discussing many matters that cannot be discussed in a regular meeting. In view of this, approximately 30 per cent of the time will be given over to recreation and sports.

The program has not been definitely outlined as yet, but the general plan is to devote 50 per cent of the time to discussion and handle only a few important subjects. Thus the "Future Design of the Passenger Car" will be the subject for an entire session.

In a similar way the questions relating to production as concerned with cars, trucks, tractors, motorcycles, etc., will be the subject of an entire session. It is hoped to handle motor trucks, farm tractors and aviation in a similar way. There will be papers on motor boating, electric lighting systems, etc.

The Meetings Committee that has the meetings of this year in charge has been appointed by President Manly and consists of: Chairman, David Beecroft, W. A. Brush, C. F. Scott, B. G. Koether and Dent Parrett.

Automotive Industries

General Motors Sales $326,044,755

Financial Report Shows Large Increase in Profits, Assets and Capital

NEW YORK, April 12—Net profits of the General Motors Corp. for the year ended Dec. 31, 1918, increased $26,127,754 over the balance for the previous year, and during that time net sales of all companies were 246,834 cars, valued at $326,044,755. During the year the company's assets increased $165,699,611. This increase in assets is made up to a considerable extent of increased holdings in real estate, amounting to approximately $46,000,000; $27,000,000 increased investment in Liberty bonds, about $44,000,000 increased value of inventory, $7,000,000 due from the government on war contracts, an increased valuation of $24,000,000 on good-will, patents, etc., and about $16,000,000 increase in notes and accounts receivable.

After deducting reserves for federal taxes and other contingencies amounting to $28,000,000, the surplus for the year increased $24,900,545 and is now $36,408,937. On Jan. 1, 1918, the working capital of the corporation was $64,554,765, but by Dec. 31 this had increased to $149,902,028, the increase being $85,347,263. The net manufacturing profits amounted to $35,504,576, after deducting $4,616,344 to cover depreciation of buildings, machinery and equipment. These profits are exclusive of profits which accrued to the several companies in 1918 prior to their acquisition by the corporation.

The combined profits of the corporation and subsidiary companies before deducting Federal taxes for the twelve months ended Dec. 31, 1918, and including the proportion of profits which accrued to the several companies in 1918 prior to their acquisition by General Motors, amounted to $45,541,726.

Included in the consolidated balance sheet are the assets and liabilities of the following divisions and subsidiary companies, in addition to various sales companies with nominal capitalization:

GENERAL MOTORS GROUP

Buick Motor Co. Division.....Flint
Cadillac Motor Car Co. Division.....Detroit
Central Forge Co. Division.....Detroit
General Motors Truck Co. Division..Pontiac
Jackson-Church-Wilcox Co. Division.Saginaw
Northway Motor & Mfg. Co. Division..Detroit
Oakland Motor Car Co. Division.....Pontiac
Olds Motor Works Division.....Lansing
Samson Tractor Co. Division.....Janesville
Scripps-Booth Corp. .....Detroit
Champion Ignition Co.....Flint
The McLaughlin Motor Car Co., Ltd..Oshawa
The McLaughlin Carriage Co., Ltd...Oshawa
General Motors Export Co.....New York
General Motors (Europe), Ltd.....London
Janesville Machine Co.....Janesville

CHEVROLET GROUP

Chevrolet Motor Co. of Michigan .....Flint
Chevrolet Motor Co. of New York, Inc. Tarrytown
Chevrolet Motor Co. of Texas ...Fort Worth
Chevrolet Motor Co. of St. Louis..St. Louis
Chevrolet Motor Co. of Canada, Ltd..Oshawa
Chevrolet Motor Co. of Bay City...Bay City
St. Louis Mfg. Corp.....St. Louis
Toledo-Chevrolet Co. .....Toledo

UNITED MOTORS GROUP

Dayton Engineering Laboratories Co..Dayton
Hyatt Roller Bearings Division.....Newark
Jaxon Steel Products Division.....Jackson
Remy Electric Division.....Anderson
Harrison Radiator Corp.....Lockport
New Departure Mfg. Co.....Bristol
Lancaster Steel Products Co.....Lancaster

Following are excerpts from the report of the General Motors Corp.:

The net sales of General Motors Corp. and subsidiary companies for the twelve months ended Dec. 31, 1918 (not including the sales of the companies purchased during the year prior to their acquisition), amounted to $269,796,829.78. The net sales of all companies for the twelve months ended Dec. 31, 1918, amounted to $326,044,755.95. The number of cars, trucks and tractors sold during the year was 246,834.

The payrolls for the year 1918 aggregated $52,500,000. The number of employees in the service of the corporation and its subsidiary companies on Dec. 31, 1918, was 49,118.

Concerning the work done by the corporation on war products, a word at this time may not be out of place. Of the twenty-three operating units, eighteen were engaged on government contracts. The gross value of the products actually completed was approximately $35,000,000. At the time the armistice was signed the orders and contracts in hand exceeded $50,000,000.

The United States had been at war hardly a month when the Truck Division received a large order for its Model 16 chassis to be used for ambulance mounts. During the Mexican trouble this chassis, in actual service, had proven to be especially well adapted to ambulance work and was adopted by the Medical Corps for all motorized units. In the summer of 1918, after having spent months on the design of a new chassis for universal military service, the Army finally acknowledged the sterling worth of the G.M.C. Model 16 chassis by making it the standard ¾-ton chassis for all arms. General Motors furnished over 5000 of these vehicles.

The Quartermaster's Corps, supplying the majority of the vehicles used by all branches of the service, early adopted the Cadillac as the standard officers' car. A total of 2350 Cadillac cars practically standard in all respects were supplied.

The Cadillac eight-cylinder engine, with a few slight changes, was adopted by the Ordnance Department as the power plant for the 2½-ton artillery tractor. A total of 1157 engines were supplied for this purpose.

In the production of Liberty motors for aircraft work, the Buick and Cadillac divisions made an exceptional record. Regardless of the delayed start, due to the fact that the General Motors Corp. had been

(*Continued on page* 871)

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To Sell 1000 Liberty Engines

WASHINGTON, April 17—One thousand Liberty engines have been placed on sale by the War Department. They are 12-cylinder, V-type, 5 x 7, 400 hp., at 1700 r.p.m., and are equipped with a Delco generator, battery-type ignition, and two complete distributing units working independently with specially designed Zenith duplex carbureter. These engines are all new and are a surplus above the requirements of the Air Service. Bids should be made to the Sales and Salvage Section, Army Air Service, Washington.

SKF and Hess-Bright Brought Together

With Atlas Ball, They Form SKF Industries—Establish Research Laboratory

NEW YORK, April 17—The SKF Administrative Co., which was formed in May, 1917, to consolidate the interests of the SKF Ball Bearing Co. and the Hess-Bright Mfg. Co., has been merged, with the Atlas Steel Ball Co. into a new company to be known as SKF Industries, Inc. The Atlas company has for some time been controlled by the SKF company.

The immediate purpose of the merger, which brings together the sales and executive departments of the three companies, is to facilitate the carrying on of important research work. For this purpose ground is being broken adjacent to the Hess-Bright plant in Philadelphia.

The merger will not affect the financial status of any of the companies and is largely to simplify merchandising problems. Heretofore, Hess-Bright and SKF bearings have been sold separately and in competition. Hereafter, they will be sold by the same sales organization, with the assistance of the research and engineering laboratory, and not in competition. Both names will be perpetuated, Hess-Bright for the company's deep-groove type of bearing, and SKF for its double-row self-aligning type. The establishment of the laboratory permits the company to give scientific advice on anti-friction matters, entirely divorced from the sale of any specific type of bearings.

B. G. Prytz, who has been president of all three companies, is president of the new company. Associated with him are: Vice-president, W. L. Batt, formerly vice-president of the Hess-Bright company; Comptroller J. P. Walsh; Sales Manager S. B. Taylor, formerly vice-president of the SKF company.

The company will consolidate its sales and executive offices at 165 Broadway, New York. The SKF, Hess-Bright and Atlas plants, the former in Hartford, and the latter two in Philadelphia, will be maintained without change.

—

Holt-Best Patent Litigation Settled

SAN LEANDRO, CAL., April 11.—Litigation between the Holt Mfg. Co. and the C. L. Best Gas Traction Co. over certain patents has been adjusted. The Holt company has acquired the Lombard patents, Nos. 674,737 and 854,364, from the Best company and has licensed that company to manufacture under the Holt patents. The number of the patent in the suit instituted by Holt is 874,008.

Militor-Knox Merged as Militor Corp.

Will Continue Militor Motorcycles and Knox Engines and Add Passenger Car

NEW YORK, April 12—The Knox Motors Co., Springfield, Mass., and the Militor Corp. have been merged and will do business as the Militor Motors Co., with a capital of $2,500,000. The company plans to increase the production of Militor motorcycles and will also add a light passenger car. It is planned to continue production of Knox engines.

The original Militor Corp. was organized for the production of war vehicles for the Government, and received contracts for a considerable number of four-wheel-drive trucks, though these contracts were canceled before the company could get into actual production on them. The Militor motorcycle is a four-cylinder, shaft-driven vehicle which differs from other motorcycles in that it is of automobile construction to a very great extent.

N. R. Sinclair, president of the Militor Corp., will be president of the new company. Associated with him are George W. Dunham, vice-president of the Militor Corp. and formerly president of the S. A. E.; second vice-president, R. L. Notman, secretary of the Militor Corp. and formerly vice-president of the McKinnon Dash Co.; treasurer, E. O. Sutton, formerly treasurer of the Knox Motors Co. Production activities will be centered in the Springfield plant, which has more than 230,000 sq. ft. of floor space and a complete equipment of machinery. General executive and sales offices are at 111 Broadway, New York.

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Fokker Airplanes to Be Made in Holland

WASHINGTON, April 12—A factory is being erected in Holland for the manufacture of Fokker airplanes, according to information received here by the War Department. Two American army officers, Col. Earl McFarland and Major Robert Marsh, Jr., have been assigned to visit the factory and study the Fokker plane, afterward reporting to the American military attaché at The Hague.

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U. S. Chamber of Commerce Convention at St. Louis

WASHINGTON, April 12—The meeting of the Chamber of Commerce of the United States at St. Louis, April 28-May 1, will include in its program discussion on the disposition and operation of the country's railroads and merchant marine, revision of anti-trust legislation, foreign relations and foreign trade, agriculture, industrial production, domestic distribution, waterways and highways, industrial relations and finance. The Advisory Council of American Industries, which comprises 400 war service committees, has been asked to attend the meeting.

Speakers already designated include Carter Glass, Secretary of the Treasury; William C. Redfield, Secretary of Commerce; Edward N. Hurley, chairman of the Shipping Board; Walker D. Hines, Director of Railroad Transportation; Senator Albert B. Cummins; George Ed Smith, President of the Manufacturers' Export Association, and Maurice Casenave, former French Minister to Brazil, now Director-General of French Services in this country, who will speak as the special representative of France.

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French Accessory Competition

PARIS, March 26—On June 9 the Touring Club of France will hold a competition for the equipment of automobiles for extensive touring and camping. This competition is a part of the program drawn up by the club in celebration of its twenty-fifth anniversary.

It is felt that very few automobiles are so designed that accessories, such as tires, rims, tools, batteries, etc., can be carried conveniently. The object of the competition is not only to find the best ways of lodging these essential accessories, but also to reveal the best methods of carrying baggage and touring equipment. Light two-wheel trailers suitable for placing behind a passenger-carrying automobile will be admitted at this competition.

—

Major Halford in America in Interest of English Patents

NEW YORK, April 12—Major F. B. Halford, representing Engine Patents, Ltd., of England, which developed the Ricardo cross-head piston type engine used in the British tanks, and also the slipper design of piston, arrived in New York recently in the interest of American patents on these products, and also the possible development of them in America.

Major Halford was one of the three to develop the B.H.P. aviation engine which was used so much in British bombing planes, and of which perhaps over 6000 have been built. The B.H.P. was a 6-cylinder design and in 1916 was fitted in the first DH-4 bombing plane. With cylinders 145 x 190 it furnished approximately 1 hp. for every 2¼ lb. in weight. The object of the development of the B.H.P., which took its name from the three men who worked on its development, namely, Sir William Beardmore, Major Halford and T. C. Pullinger of Arrol-Johnson, was to give maximum reliability without excess weight. It was a direct-drive engine, and with its use the speed of the bombing planes was increased from 92 to 116 m.p.h.

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Closing of Cleveland Plants Throws 1200 Out of Work

CLEVELAND, April 11—The entire works of the Theodore Kundtz Co., comprising five plants, were closed to-day, throwing more than 1200 men and women out of work. Officials say that the step was taken because of agitation among the workers for a wage advance of 10 cents an hour and a 6-hr. day.

$152,000,000 Voted for French Roads

$112,000,000 for Devastated Area —65,000 Miles to Be Entirely Rebuilt

PARIS, March 25—The sum of $152,000,000 has been voted by the French Government for the repair and upkeep of roads. Of this amount $112,000,000 will be devoted to the repair of roads in the devastated regions of France. Approximately $40,000,000 are to be spent on the repair of roads which have indirectly suffered owing to the war. These include roads which, owing to military activities, have had to carry an amount of traffic for which they were never designed.

Careful examination of the roads situation in France shows that 65,000 miles of main roads in the war area must be entirely rebuilt. In addition to this several hundred bridges, which at present are of a temporary nature, must be reconstructed. It is estimated that to put these war-stricken roads into proper condition 10,400,000 tons of material will be required. The estimated cost of this work is $64,000,000. This is in addition to the $48,000,000 which have already been spent by the military authorities during the war for the maintenance of roads in the war area.

For the past 4 years all the roads in the war zone of France have been under the direct control of the army authorities. At the end of April this control will be taken away from the army and vested in the Ministry of Public Works, which will occupy itself not only with the main or national highways, but also with the local or departmental roads. In the past the State only maintained national roads, leaving the upkeep of the secondary roads to the department or local authorities. In view of the enormous task facing it, this divided control has been abolished. All the gravel pits and stone quarries at present worked by the military authorities will be taken over by the Ministry of Public Works. Also all road work which is now handled by the American and British armies will be transferred to the French civilian authorities. Many of the contracts for this scheme have already been placed, and it is believed that active work on the repair of roads will begin by the end of April.

Repair Outside War Zone

The second part of the program, which deals with the repair and improvement of roads outside the war zone, is almost as big as the first. In asking for and obtaining a credit of $40,000,000 the French authorities realize that a tremendous effort must be made to make the roads equal to their condition of 10 years ago. A technical committee has been appointed to determine the kind of material necessary for each type of road. It is probable also that there will be a reclassification of roads.

Since the development of the automo-

bile many roads which were classified as fourth or fifth grade have become of primary importance. These roads should have spent on them an amount of money commensurate with the traffic they have to carry. Under this scheme it is estimated that it will be necessary to furnish immediately 5,000,000 sq. yd. of broken stone and to repair more than 1,000,000 sq. yd. of granite-paved road.

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Pershing Highway Planned

WASHINGTON, April 11—The Department of Labor plans to construct a highway, to be known as the Pershing Highway, across the continent from New York to San Francisco, touching various places connected with the life of the commander of the American Expeditionary Forces. A temporary association has been formed for this purpose, and it is believed all the States will co-operate. A preliminary meeting was held in Lincoln, Neb.

The approval of Congress will be necessary, and appropriations made by Congress. Nearly 800 road projects have been approved in various States, and $21,000,000 as now available for State roads, according to the Federal Road Aid Act, by which the Government allows the individual States as large an amount as the States themselves appropriate for road construction.

Nebraska has taken the lead in the Pershing idea and also has 13 road projects of 388 miles approved at a cost of $809,401.43, of which $320,206.66 will be from the Federal funds. New York State has received Federal approval for 13 projects of 61 miles and California has had approved 6 projects covering 96 miles at a cost of $1,290,613.84.

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Road-Building Freights Cut

WASHINGTON, April 12—Reduced rates on road building material for Federal, State, county or municipal work were ordered yesterday by the Railroad Administration. All railroads were authorized to cut, without filing tariffs, 10 cents a ton from regular rates exceeding 40 cents a ton on all shipments of broken, crushed or ground stone, sand and gravel, slag, shells, chatts and cherts, where the benefit of the reduction would accrue to the Federal, State or local governments.

Director-General Hines took this action after conference with the Departments of Agriculture, Commerce and Labor.

Gasoline Stocks Are Well Maintained

January Figures Disclose Satisfactory Position—Production Has Increased During Month

PRODUCTION

	January, 1919	December, 1918
Crude oil (bbl.)	26,967,332	26,958,157
Gasoline (gal.)	303,710,556	291,744,465

	Stocks on Hand—Jan. 31, 1919	Stocks on Hand—Dec. 31, 1918
Crude oil (bbl.)	15,380,185	15,749,771
Oils purchased to be run (bbl.)	1,088,264	1,300,018
Gasoline (gal.)	383,212,692	297,326,983
Kerosene (gal.)	332,393,181	380,117,829
Gas and fuel (gal.)	646,411,414	359,001,357
Lubricating (gal.)	158,370,431	138,853,574
Wax (lb.)	189,064,329	199,657,542
Coke (ton)	28,732	22,605
Asphaltum (ton)	93,027	76,858
Miscellaneous (gal.)	483,942,833	477,783,740

WASHINGTON, April 14—In comparison with the past few months, the figures relating to petroleum products for the month of January, 1919, are very satisfactory.

It is true that production of crude oil has remained practically stationary as compared with the total for December, 1918, and gasoline production has increased by less than 12,000,000 gal. Nevertheless we are now getting the benefit of decreased consumption and, accordingly, the position in regards to stocks held on Jan. 31 last is distinctly good.

It is reasonable to suppose that gasoline consumption should be at its lowest point around January, and no doubt it is mainly for this reason that our stock has increased by about 85,000,000 gal. Stock of fuel oil has increased by no less than 287,410,057 gal., a circumstance which augurs well for the maintenance of our new oil-burning merchant marine. Our stock of lubricating oil is also satisfactory, but stocks of crude and kerosene show slight decreases.

Almost all through the year 1918 consumption of crude petroleum and, inferentially, its derivatives has been in excess of production. In June the lines of production and consumption crossed for about a week, but later on the position altered and it was not until almost the end of December before production was again in excess of consumption. In January, 1919, both consumption and production dropped, but as the former decreased more rapidly our position improved.

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Gasoline Shortage Affects South African Trade

WASHINGTON, April 12—Shortage of gasoline in British South Africa has affected the use of motor cars and trucks, according to a report from the American consul. Sales of gasoline were suspended by the Government in order to insure adequate supplies for military use. The position is not so serious now, and gasoline is again being sold for commercial requirements.

Parliament has legislated that no excise duty should be levied on Union spirits or on ether manufactured from spirits, if they are used for internal-combustion engine fuel, in order to stimulate and encourage the establishment of a motor fuel industry. As a result a factory has been erected near Durban costing $400,000 and with a full capacity for 3000 gal. daily. This fuel is being placed on the market at a price just below that of gasoline. No statement can be made yet as to its success as a substitute fuel. Warnings have been issued against its used in carbureters with cork floats, as it apparently contains some denaturing chemical which quickly destroys the shellac coating.

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Carload Shipments Increase 5000 in March

NEW YORK, April 15—Shipments of automobiles increased nearly 5000 carloads in March, 1918, over the same month last year. In March, 1918, the shipments totaled 16,728, as compared with 21,500 in March, 1919, according to figures presented before the monthly meeting of the directors of the National Automobile Chamber of Commerce.

In the last month the condition of the factories in so far as their ability to get automobile freight cars is concerned has been materially bettered. This has been brought about through the efforts of the N. A. C. C. in having a representative of the railroads permanently located in Detroit with authority to check up and route freight cars.

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DALLAS, April 15—The Spencer-Carroll Co. has moved from Waco, Tex., and will now operate its wholesale business in automotive equipment from that center.

Output of Refineries of the United States by Months

1918	Crude (bbl.)	Other Oils (bbl.)	Gasoline (gallons)	Kerosene (gallons)	Gas and Fuel (gallons)	Lubricating (gallons)	Wax (pounds)	Coke (tons)	Asphaltum (tons)	Miscellaneous (gallons)	Losses (bbl.)
January	23,842,587	2,300,334	242,632,044	119,358,184	547,866,248	56,623,425	39,238,858	41,216	54,854	70,995,829	1,078,181
February	23,386,676	2,298,333	234,324,618	121,218,320	510,165,397	58,300,914	35,087,337	42,371	42,033	75,134,088	983,992
March	26,239,662	3,696,872	269,627,968	151,228,007	587,985,804	69,308,351	43,597,019	44,248	56,901	94,865,148	1,097,489
April	26,201,544	3,956,244	293,396,162	153,703,682	578,255,341	71,022,204	40,173,524	45,674	51,242	89,242,012	1,182,020
May	28,510,698	4,112,023	319,391,202	160,590,760	631,586,209	79,589,735	42,544,633	48,864	60,449	88,627,491	1,269,281
June	28,140,479	3,483,270	315,023,445	151,840,252	628,842,033	74,420,996	41,317,794	46,605	50,321	81,110,922	1,282,177
July	29,170,718	5,951,537	332,022,095	156,828,826	658,439,682	79,303,107	41,691,551	48,914	58,433	159,374,139	1,338,304
August	28,534,275	6,376,353	330,335,046	149,678,850	671,113,871	72,892,879	41,829,516	51,759	59,715	163,345,034	1,337,327
September	28,390,431	5,485,747	314,595,959	164,963,798	653,085,050	70,593,079	42,704,894	48,052	49,157	138,201,963	1,236,834
October	29,237,767	5,571,847	314,251,318	164,928,640	661,780,441	72,244,633	43,470,132	48,820	51,878	166,109,867	1,161,545
November	27,411,636	3,857,754	312,968,640	169,278,105	604,403,494	72,178,602	49,642,007	51,393	35,387	75,430,160	1,236,818
December	26,958,157	3,474,890	291,744,465	161,742,713	587,873,987	64,987,842	43,847,092	41,747	37,596	84,273,730	1,352,657
Total	326,024,630	50,565,204	3,570,312,963	1,825,360,137	7,321,397,557	841,465,767	505,144,357	559,663	607,968	1,286,710,383	14,556,625
1919											
January	26,967,332	* 919,492	303,710,556	158,501,260	589,630,056	68,304,613	44,987,603	59,003	54,074	92,324,236	1,183,767

Purchasing Pitfalls Pointed Out

Detroit Purchasing Agents Hear of Wide-Open Traps for the Unwary Buyer

DETROIT, April 14.—How to avoid legal pitfalls in buying was pointed out by Edward G. Wasey, a prominent attorney, at the April meeting and dinner of the Detroit Branch of The National Association of Purchasing Agents, held on April 9. Mr. Wasey pointed out a number of the wide-open traps which catch the unwary buyer unless he is posted on the laws which regard his occupation. His speech followed the banquet and was heard by about 100 prominent purchasing agents of Detroit. A digest of his remarks follows:

"In buying goods where the purchasing price is over $50, there must be a written contract in order to make the sale valid. If, however, special manufacturing operations have to be gone into to produce the goods, or if a part of the order has been delivered, a contract has been consummated. As a rule, however, goods purchased to the extent of over $50 must be purchased through a written contract.

"It is necessary that the man with whom the contract is made have the power to make the contract. This is something which must be watched carefully, as in the employee's contract with his company he may be limited in his powers, and the purchasing agent should not close the purchase, nor should the salesman, on the other hand, conclude a contract, unless he is reasonably sure that the person with whom the contract is being closed is empowered to make the purchase."

Another matter similar to this which must be watched is that a concern is doing business along the lines for which it is incorporated. That is, a corporation cannot be held responsible for debts incurred in doing business in a field for which it is not incorporated. For example, if a concern is incorporated to manufacture a certain article, and for some reason takes a part of its capital and invests it in a farm and starts paying on this farm and suddenly ceases payment to the land company, that land company would have no redress against the corporation, since that is a business beyond the powers of the corporation to conduct.

This defense, known technically to lawyers as *ultra vires* (meaning beyond the powers), is quite common and must be guarded against by the seller in making his contract. That is, he should know that the concern with which he is contracting is undertaking to do something that is directly in its line of business. Of course, the individual officers of the company are liable for the bill incurred in the case of an *ultra-vires* defense.

Another very important requirement is the use of printed forms of contract wherever possible. With such it is highly improbable that anything will be omitted from the contract. Mr. Wasey points out a very typical example of this. A lease was drawn up stating that the tenant was to return the property to the landlord in as good condition as he received it, taking into consideration normal wear and tear, and not including damage by the elements such as fire or flood. By an error the last phrase was left out.

The property was damaged by fire and the building burned to the ground, whereupon the tenant wrote the landlord asking him when he was going to rebuild the property. The tenant was very much surprised to receive a reply from the landlord stating that it was up to him to rebuild the property. A study of the lease showed that this important phrase had been left out and the tenant was forced to rebuild.

Another thing that both the purchasing agent and the seller must watch is that there is an agreement between the parties buying and selling. Sometimes, where a case is brought into dispute, one of the disputing parties will bring a mass of correspondence to the attorney's office, and somewhere in that correspondence is supposed to be evidence that the parties have agreed upon the purchase and sale, or on the specifications or other matters necessary in consummating the deal. Very often a careful search through the entire correspondence fails to reveal any such agreement. It is very necessary therefore, that the purchasing agent so arrange his correspondence on the matter of the sale or purchase as to bring out the fact that there is a definite agreement.

Another failure in the conducting of business along purchasing lines is that of the concern which fails to describe plainly the goods that are to be bought or sold. It is also highly advisable to put in the contract the exact purpose for which the goods are suitable. This then binds the seller to deliver materials or products which are satisfcatory for the purpose intended. Some of the purchasing agents go further than this, and are able to "get away with it" in most instances. They incorporate a phrase stating that the goods must be to the satisfaction of the buyer.

Mr. Wasey dwelt at some length on the bad results of buying too cheaply. If the price is made too low and the seller is not able to make a reasonable profit, the quality of the goods is lessened, or in some way the lack of profit is made up. A concern which forces another concern to operate at a loss to fill an order is not going to get the same sort of treatment as one that allows a reasonable profit, and eventually this curtailment of price will some back in some detrimental way to the purchaser.

The practice of canceling parts of orders increases the risk of the seller and naturally, since he is taking a higher risk, he will ask higher prices. In the case of cancellation, the buyer is also liable for anticipated profits and in some cases for a certain portion of the cost of material if it has been bought specially. The only way of getting around this situation correctly is to make an option form of contract. Wherever the buyer forces the seller to take a risk he must be willing to pay for it.

It is always advisable, if possible, to pay bills quickly. There are certain concerns which have a habit of sending out vouchers on the day the invoice is received or, at most, the day following. This practice is highly beneficial to the seller, as it is a factor in allowing him to turn over his capital more quickly.

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Improvements in New DeDion

NEW YORK, April 17—The post-war program of DeDion Bouton has been slightly uncovered, and details of one of the new models which will be on sale in America by the end of June have reached this city. It about follows the previous DeDion design, using a "V" type 8-cylinder engine which is improved in many respects. Cylinder dimensions are 70x120 mm., wheelbase 134⅜ in. and tires 34x4½ in. with standard tread.

Several unusual features are the mounting of the four-speed gearset as a unit with the engine, and the adoption of a conventional rear axle, consisting of a stamped housing with floating drive shafts, in place of the former double type, consisting of a fixed axle with a separate driving system and the differential mounted on the frame and transmitting by two universal shafts to the wheels.

The car is fitted with a single-unit motor-generator for starting and lighting, driven by a silent chain. The springs are very flat semi-elliptical types. Thermo-syphon cooling is retained.

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Kalamazoo Spring President Dies

DETROIT, April 17—Charles H. Eaton, president of the Kalamazoo Spring & Axle Co., died yesterday after a brief illness.

Government Vehicles Not For Sale

Federal Requirements Likely to Account For All War Trucks and Cars — Remainder to Makers

WASHINGTON, April 15—Reports, current during this past week, that many thousands of trucks and passenger cars would be thrown on the market in the next few days are untrue. The rumors are the result of action taken by the War Department to learn what possible surplus of trucks and passenger cars can be expected as a result of the reorganization of the army.

Following the inquiry by Acting Secretary of War Benedict Crowell, the Motor Transport Corps notified him that after detailing trucks and passenger cars to the various divisions of the army in accordance with the reorganization plans there will probably be about 30,000 motor trucks and 5000 passenger cars surplus, most of the passenger cars being Fords, while the trucks are divided up among all the different makes which were ordered during the war, some of them new and the balance used.

This surplus, however, is not an indication of a sale to the public. As soon as these amounts are definitely ascertained the War Department will ask the various government bureaus for requisitions for trucks and cars to meet their needs.

The plan is to first provide all government departments with their requirements and then if there is a surplus to allow the manufacturers to rebuy their cars and trucks at reasonable prices. Third, if after these two methods are used a surplus still remains, it will be disposed of by auction sale to the public. It is not expected, however, that there will be any vehicle left for public purchase, and it is very doubtful if there will be any for resale to the manufacturers.

The Post Office Department, the Department of Agriculture, the Department of Commerce, the U. S. Health Service and, in fact, all of the government agencies, are expected to make demands for a large number of the vehicles, probably for more than the War Department can spare. The Post Office originally requisitioned 16,000 motor trucks; 3000 of these have been delivered.

Of the remaining 13,000 the Post Office Department is now able to take only 4000 whenever the War Department can provide them due to the fact that the Post Office appropriation bill failed to pass in Congress in the recent filibuster. The remaining 9000 trucks will be asked for by the Post Office Department if the bill passes in the next session of Congress.

The Department of Agriculture has already signified a need for 1000 passenger cars, 4500 trucks and several hundred trailers, and anticipates that it will use considerable more than this as soon as it definitely formulates its road building program. The plan is to use these cars and trucks for road construction.

The U. S. Health Service has already taken 1000 ambulances, and will take all that the army can spare, which may possibly mean that ambulance bodies will be fitted to some of the truck chasses to meet the needs of the U. S. Health Service.

Likewise, the Departments of the Interior, Commerce, Labor, etc., are expected to ask for considerable numbers of vehicles, all of which can be turned over to the different government agencies under the Act of Congress which authorizes the Secretary of War to meet any such requisitions. Consequently it appears at this time that there will be very few vehicles, if any, remaining to be offered for resale to the manufacturers.

General Motors Sales $326,044,755

(*Continued from page* 867)

selected to build a special type rotary engine which was afterward abandoned, Liberty motors were being delivered within five months from the time the contract was taken. The high standard of excellence of the product of these divisions has everywhere been recognized. At the time the armistice was signed there were orders for over 10,000 Liberty aircraft engines on the books and 2528 Liberty engines were actually completed and delivered.

The Jackson-Church-Wilcox Division, operating an entire plant on trench mortar shells, reached a production of 20,000 per day. This division holds the record as the largest producer of these shells in America. Substantially every claim against the government has been satisfactorily adjusted.

The development of the tractor business is continuing most satisfactorily, and production of Samson tractors in quantities is expected to be reached shortly.

During the year the corporation acquired the following interests:

All the assets of Chevrolet Motor Co., a Delaware corporation (except 450,000 shares of General Motors Corp. common stock), as of May 2, 1918, paying therefor $28,268,400 par value of common stock.

All of the common capital stock ($1,000,000 par value) of the Janesville Machine Co., Janesville, Wis., on July 1, 1918, paying therefor $1,000,000 in cash.

A controlling interest on July 1, 1918, in the no par value common stock of the Scripps-Booth Corp., paying therefor through an exchange of securities on the basis of one share of General Motors common stock for six shares of no-par value Scripps-Booth stock.

All of the capital stock of Chevrolet Motor Co. of Canada, Ltd., the McLaughlin Carriage Co., Ltd., and the balance of the capital stock of the McLaughlin Motor Car Co., Ltd., not already owned by the corporation, as of Nov. 1, 1918, paying therefor $4,900,000 par value common stock and $550,000 in cash.

All the assets of United Motors Corp., subject to liabilities, as of Dec. 31, 1918, paying therefor $29,869,200 par value debenture stock, $9,956,400 par value common stock, and 106,000 shares of United Motors stock owned by General Motors Corp., plus an amount in cash equal to the dividends on the debenture and common stock subsequent to Oct. 1, 1918.

All the preferred and common stock of Lancaster Steel Products Co. and $1,566,000 par value of General Motors debenture stock as of Dec. 31, 1918, paying therefor $1,617,500 par value common stock and $500,000 par value debenture stock.

All of the ($387,100 par value) Harrison Radiator Corp. preferred stock as of Dec. 31, 1918, paying therefor $387,100 par value debenture stock and $38,710 in cash.

There was authorized an issue of $24,000,000 par value of common capital stock, which was sold without expense to the corporation, for $28,800,000 subject to the right of the common stockholders to subcribe therefor.

The corporation has adopted a bonus plan under which stock of the corporation is distributed each year as a reward to its employees, including employees of subsidiary companies, who have contributed to its success in a special degree, by their inventions, ability, industry, loyalty or exceptional service. It is hoped thereby not only to compensate services rendered, but also to encourage further efforts by making its employees partners in the corporation's prosperity. Under the bonus plan, the amount which may be distributed each year is determined by taking 10 per cent of the net earnings of the corporation after deducting therefrom an amount equal to 6 per cent on the capital invested. The bonus plan is in no sense a "profit sharing plan" in the meaning of that term as generally used. There was awarded for the year 1918, under this plan, a total of 24,334 shares of the common capital stock of the corporation, at a cost to the corporation of approximately $2,798,410.

The outlook for the coming year is most promising. Since the signing of the armistice and the subsequent liquidation of the war contracts, which your corporation was engaged in, the plants and facilities have been reconverted in an incredibly short time to their regular lines of activity, and as a result the manufacturing operations are considerably advanced, as is evidenced by the showing for the first quarter of 1919; the number of cars, trucks, and tractors sold to March 31, 1919, inclusive, being 82,456; the net profits before deducting Federal taxes are estimated at upward of $20,000,000.

Condensed Comparative Consolidated Balance Sheet of General Motors Corp. and Subsidiary Companies as of Dec. 31, 1918 and 1917

ASSETS

	Dec. 31, 1918	Dec. 31, 1917
Permanent Investment:		
Real estate, plants and equipment	$86,818,414.51	$40,086,374.34
Less: reserve for depreciation	10,061,983.38	1,428,539.28
	$76,756,431.13	$38,657,835.06
Investments in allied and accessories companies	$2,839,531.23	$2,030,273.48
Current and Working Assets:		
Cash in banks and on hand	$30,636,621.48	$18,865,645.27
Liberty Bonds	28,852,018.00	1,255,000.00
Marketable securities	172,304.86	.....
Sight drafts against B/L attached	3,316,384.90	7,590,279.25
Due from United States Government on war contracts	7,305,626.76	449,855.83
Notes ($1,285,908.01 in 1918) and accounts receivable	21,995,359.50	5,555,403.34
Inventories at cost or less	91,137,512.59	46,559,394.15
Total Current and Working Assets	$183,415,828.09	$80,275,577.84
Deferred expenses	$762,651.85	$854,434.61
Good-will, patents, copyrights, etc	$35,714,893.43	$11,971,603.48
Total	$299,489,335.73	$133,789,724.47

LIABILITIES

Capital Stock:		
Debenture stock (authorized $150,000,000) issued	$30,756,300.00	.....
Less: in treasury of General Motors Corporation	1,581,000.00	.....
In hands of public	$29,175,300.00	.....
Preferred stock (authorized $20,000,000) issued	$19,684,300.00	$19,676,800.00
Less: in treasury of General Motors Corporation	13,300.00	
In hands of public	$19,671,000.00	$19,676,800.00
Common stock (authorized $200,000,000) issued	$151,301,100.00	$82,558,800.00
Less: in treasury of General Motors Corporation	3,921,200.00	5,685,500.00
In hands of public	$147,379,900.00	$76,873,300.00
Total in hands of public	$196,226,200.00	$96,550,100.00
Purchase Money Bonds	$225,000.00	
Outstanding Capital Stock (par value) and surplus of subsidiary companies, being the portion not owned by General Motors Corporation:		
Capital Stock	$2,960,400.83	$540,500.00
Surplus	427,754.20	859,083.18
Total	$3,388,155.03	$1,399,583.18
Current Liabilities:		
Accounts payable	$18,453,316.99	$10,665,717.52
Notes payable	10,802,154.11	.....
Taxes, pay rolls, and sundries accrued not due	3,769,865.29	4,858,326.57
Total Current Liabilities	$33,025,336.39	$15,524,044.09
Reserves:		
For two months' proportion of dividend on preferred and debenture stock, payable Feb. 1	$488,463.00	$196,768.00
For Federal taxes and extraordinary expenditures	25,863,823.23	6,939,018.55
For sundry contingencies	3,863,420.65	1,671,818.08
Total	$30,215,706.88	$8,807,604.63
Surplus	$36,408,937.43	$11,508,392.57
Total	$299,489,335.73	$133,789,724.47

Income Account for Twelve Months Ended Dec. 31, 1918

Net profits after deducting all expenses of manufacture (including maintenance) selling and administration, as well as ordinary taxes, insurance and depreciation		$35,504,576.41
Less: Provision for Federal taxes and extraordinary expenditures		20,113,548.19
		$15,391,028.22
General Motors Corporation proportion thereof		$14,825,530.19
Preferred dividends for 12 months at rate of 6%	$1,180,901.00	
Debenture dividends for 5 months at rate of 6%	739,566.00	1,920,467.00
Undivided profits for 12 months ended Dec. 31, 1918.		$12,905,063.19

Profit and Loss Account

Profit and loss surplus at the beginning of the year		$11,508,392.57
Add undivided profits per Income Account above		12,905,063.19
Additions through acquisition of properties:		
Chevrolet Motor Company (of Delaware)	$8,065,083.10	
United Motors Corporation	9,714,607.59	
Other companies	653,100.98	
Profit from sale of new common stock	4,800,000.00	23,232,791.67
		$47,646,247.43
Less: Cash dividends paid on common stock:		
February 1, 1918—3%	$2,292,150.00	
May 1, 1918—3%	2,292,567.00	
August 1, 1918—3%	3,205,704.00	
November 1, 1918—3%	3,446,889.00	11,237,310.00
Profit and loss surplus December 31, 1918		$36,408,937.43

NOTE—The various tangible and intangible assets acquired by the corporation during the year were valued and written on the corporation's books at the same aggregate amount as they had been carried on the books of the corporations so purchased. As these amounts are in excess of the par value of the securities of the General Motors Corporation issued in payment for such assets, the difference results in an addition to the surplus account of the corporation, as shown above.

The properties of the Chevrolet Motor Company of Canada, Ltd., The McLaughlin Carriage Company, Ltd., and The McLaughlin Motor Car Company, Ltd., which were acquired during the year, were appraised and the book values adjusted to agree therewith.

Will United States Hold Trade in the Argentine?

WASHINGTON, April 11—Asking the question, "Will the United States hold its present trade in Argentina?" Commercial Attaché R. S. Barrett at Buenos Aires states that while this country will lose business which will be diverted to Europe, on the other hand imports to Argentina of automobiles, motor trucks, parts and accessories should increase. He points to the fact that the war decreased imports on these commodities and that the great demand now will probably be filled by the United States.

His report states that American manufacturers are beginning to study, know and meet the requirements of the Argentine buyer, and with the establishment of two branches of important national banks of the United States in Argentina, together with the general adoption of trade acceptances, has made the financing of shipments to Argentina easier, and allows the American manufacturer to grant the credit necessary to compete with other countries.

He also states that American concerns are establishing branch houses in Argentina which sell automobiles and parts directly, and that this is encouraging trade. Furthermore, large Argentine concerns heretofore were controlled by large European capital, but are now buying in the United States, locating buyers in this country, and will probably continue their trade.

The United States, says the report, should be placed on a parity with European nations in the matter of shipping and freight rates, must train young men for foreign service, must adopt some plan to protect the Argentine buyer from unscrupulous and unreliable merchants, and should invest American capital more freely in South American securities of proven worth.

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French Tractor Trials

PARIS, March 25—Agricultural tractor trials will be held in Lorraine about the end of May, and also in Alsace, near Strasbourg, at the end of September.

The Lorraine competition is scheduled for the neighborhood of Metz, where the earth is of a heavy nature. The Strasbourg trials will take place in light Alsatian soil.

These competitions are open to allied and neutral nations.

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Kansas City Tractor Club Annual Dinner

KANSAS CITY, April 14—The Kansas City Tractor Club, with a membership of 29, gave $112,000 for the tractor show here this year, it was stated in the report of Guy H. Hall, secretary of the club, read at the annual dinner at the Hotel Muehlebach. The club is composed of managers of factory branches and distributers of tractors and tractor-drawn tools. The fifth annual Kansas City tractor show was planned for February, 1920, and Mr. Hall was elected secretary of the club and manager of the show for another year. Other officers elected were: President, R. F. Crawford; vice-president, M. R. Vorhees, and J. A. Keating, R. W. Johnston, Harry Kaufmann, G. T. O'Maley and L. T. Yount, directors.

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Wichita Demonstration Date Pushed Forward

CHICAGO, April 12—It is likely that the Wichita tractor demonstration, which was scheduled for the week of July 21, will be held instead during the week of July 14. The advance in date is probably because of land conditions. The demonstration is being staged by the National Implement and Vehicle Association, of which E. W. McCullough is secretary and general manager.

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Tractors Needed in France

WASHINGTON, April 12—Farm tractors are urgently needed in France, according to a report received by the United States Department of Labor, and especially those of the heavier types capable of plowing land that has lain fallow for the last four years and which is practically buried under a growth of thistles 2 ft. high.

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Lifting Canadian Import Restrictions a Spur to Trade

DETROIT, April 12—Reports coming from Ottawa telling of the lifting of restrictions on the importation of automobiles into Canada by the War Trades Board of Canada, if true, are going to cause a great boom in the export business of Detroit automobile makers. Customs officials at Windsor, Ont., Detroit's port of entry into the Dominion, have received no official notice of such action, however, and, in the meantime all war restrictions as pertaining to cars of the $1,250 class and over are still in full effect.

The effect of the lifting of the British war embargo on Canadian goods, thus giving the Canadian manufacturers practically free access to all parts of the British Empire, is already stimulating Canadian as well as United States automobile makers for renewed activities. Detroit manufacturers see in the lifting of the embargo an open road to the British market. This, coupled with the decision of the Crown customs officials at Windsor, who hold that an assembled car, even if assembled from parts made in the United States, may be considered a Canadian car if assembled by Canadian labor, is bringing many branch plants to Windsor and is causing Canadian part makers to plan plant extensions.

It is stated at the Border City Chamber of Commerce, Windsor, that a number of Detroit automotive factories are contemplating Canadian branches.

The Paige-Detroit Motor Car Co. has just announced its intention of establishing a Canadian assembly plant for its cars and trucks. R. D. McCain, traveling representative of the Paige Co., is in Canada looking over the situation and preparing data on the advisability of such a move.

Truck Delivery Possibilities in South America

BUENOS AIRES, April 1—Purchasing representatives have come from Chile to the United States to purchase 60 motor trucks to replace all horse carts in the delivery system of Valparaiso and Rio Santiago, Chile. In South American cities the municipal meat delivery has been generally carried on by horse vehicles, but since the start of the war there has been a growing sentiment in favor of motor trucks.

The city of Buenos Aires is a typical example of this practice, in which beef from municipal slaughter houses at one end of the city is delivered by horse carts to the retail butchers of the city. Buenos Aires uses from 220 to 250 horse carts in this service, and the delivery must be accomplished by 11 a. m. each day. At present these carts are owned by different concerns, and the thought is that they could all possibly be replaced by motor vehicles. What seems to be the greatest objection to the motor vehicle is that the work does not require the trucks for the entire day, and to use them eventually would mean employing them in some other work that portion of the day not needed for meat delivery. This calls for some interchangeable feature of bodies, which has not as yet been worked out successfully.

It was estimated recently that approximately 100 motor trucks of 3-ton capacity would be needed in this service in Buenos Aires alone, as approximately 310 tons of meat have to be delivered each day. The longest trips are 25 miles and the average would approximate 10 miles. Now that the war is over more attention is being given to this matter than formerly.

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Exhibit at Venezuela

WASHINGTON, April 11—The National Exposition of Venezuela will be held May 15-June 1, and manufacturers of automobiles, motor trucks, farm tractors and parts and accessories will be permitted to exhibit their goods.

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To Hold Pan-American Meeting

WASHINGTON, April 12—A meeting of the Pan-American commercial conference will be held here either late in May or early in June, and plans are being arranged by the Pan-American Union to invite commercial and financial experts to attend. It is expected that more than 1000 representatives of the various American republics will be present. Sessions will be held at the building of the Pan-American Union here.

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Trade With German Austria Permitted

WASHINGTON, April 9—Automotive manufacturers can now export automotive products, excepting those of a military nature or character, into German Austria, according to announcement made by the War Trade Board. Any commodities exported must be intended solely to supply domestic needs in that country.

G. M. Proposes Plan for Savings

Will Set Aside Dollar for Dollar With Employees—Classes Mature in 5 Years

DETROIT, April 14—The General Motors Corp. has inaugurated a savings and investment plan for the benefit of employees of General Motors Corp. and subsidiary companies. At the annual meeting of stockholders to be held April 30 in Wilmington, Del., an amendment to the by-laws, calling for the operation of this plan, will be submitted. Only such stockholders as are on record at the close of business, April 9, are entitled to vote on the amendment. The plan has already been approved by the officers and directors. It aims to encourage and assist all employees in the saving and investment of money and to afford them opportunity to become stockholders and share in the development of the business. Excerpts from the plan follow:

All employees who have been in the employ of the corporation or its subsidiaries for 3 months or more are eligible to participate in the plan. Each employee shall have the right to pay into the savings fund each year an amount not to exceed 10 per cent of his wages or salary, and in no event shall the amount so paid exceed $300 per annum. Payments must be made in amounts of $5 or multiples thereof.

The corporation will also establish an Employers' Investment Fund, and will pay into such fund an amount equal to the total net payments made by the employees into the savings fund. The corporation will credit interest semi-annually at the rate of 6 per cent per annum upon all amounts paid into the funds.

The savings and investment funds will be divided into yearly classes, that is, a new class will be formed each year to be designated "Class of 1919," "Class of 1920," "Class of 1921," etc., and each class will mature 5 yr. from the date of its formation; thus the Class of 1919 will mature on Dec. 31, 1924, the Class of 1920 will mature on Dec. 31, 1925, etc.

The amounts paid into each respective class of the investment fund by the corporation will be credited over a period of 5 yr. to the individual employees participating in the corresponding classes in the Savings fund, that is to say:

One-fifth thereof will be credited 1 yr. after the date of the respective payments into the savings fund; one-fifth 2 yr. after the date of the respective payments into the savings fund and so forth.

It is the intention of the corporation to invest and reinvest the investment fund, preferably in common stock of the General Motors Corp., but if this is not readily obtainable, then in such other securities as in the discretion of the board of directors may seem advisable.

Statements will be rendered periodically by the corporation to each employee showing the status of his account in both the savings and investment funds.

Upon giving 15 days' previous written notice, an employee will be entitled to withdraw all or any part of the amount to his credit in both the savings and investment funds.

Withdrawals must be made in amounts of $5 or multiples thereof. In case of withdrawals, the amount so withdrawn by the employee shall be deducted from his most recent payments into the savings fund, and from the credits in the investment fund corresponding thereto, if any. In addition, he shall forfeit the payments made by the corporation into the investment fund corresponding to the payments withdrawn by him from the savings fund, except to the extent that such payments have been credited to him in the investment fund, and such forfeitures shall be charged against his investment fund account. Such forfeitures, however, shall not revert to the corporation but shall remain in the investment fund to be distributed among the employees at the maturity of the class as provided in Section "b" of paragraph 11 hereof.

In the event of the death of an employee, his legal representatives shall be entitled to receive immediately, in cash, the full amount standing to his credit in the savings fund plus a like amount to be paid from the investment fund.

As previously stated, each class will mature in 5 yr. after its formation and at the maturity of each class each employee will be entitled:

(a) To withdraw, in cash, the total amount to his credit in the savings fund; and

(b) Either to withdraw, in cash, the total amount to his credit in the investment fund or to receive his proportion of all securities and cash them in the investment fund of that class, including all forfeitures made by employees who have withdrawn money from the class during the 5-yr. period as provided in paragraph 9 hereof.

Each employee's proportion in distribution will be in the ratio that his total credit in the class bears to the total credit of all employees in the class at maturity thereof. In case of fractional shares, adjustment will be made in cash, valuing stock at current market prices.

Should an employee so desire, he may leave with the corporation all or any portion of the amount of cash he is entitled to receive upon the maturity of each class. The corporation will hold such cash subject to his right to withdraw upon 15 days' written notice and will credit his account with interest thereon, semi-annually, at the rate of 6 per cent per annum.

Likewise, should an employee so desire, the corporation will have the stock which he receives at the maturity of each class, transferred to his name and hold the certificates in safekeeping for his account, which certificates will be delivered to him on demand.

Money Refunded on Leaving Employ

If an employee leaves the service of the corporation of his own volition or is dismissed from such service, such employee will be paid in cash an amount equal to the same amount as said employee would receive if electing to withdraw said savings at that time. However, if the employee so desires, the corporation may in its discretion, if it determines his record to be satisfactory, continue such employee as a beneficiary under this plan to the extent that said employee's payments to the date of dismissal entitle him.

The corporation shall have the right to reinstate any employee who shall have lost his membership in any class if in its judgment the circumstances surrounding the loss of such membership are such as to warrant reinstatement.

While the corporation proposes a continuance of this plan from year to year, the directors shall have the right, from time to time, to modify or entirely repeal the plan, or to discontinue the receiving of payments hereunder, either temporarily or permanently. However, no modification of this plan shall in any way affect the rights of employees hereunder insofar as they may apply to payments theretofore made.

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Jobbers to Hold Exhibit

CHICAGO, April 15—There will be a business exhibit of the Automotive Equipment Association in this city the latter part of October or first part of November in connection with the annual meeting, as was planned last year and dropped because of the war. This was decided at a meeting of the board of directors Tuesday. The matter of admitting other than members will be decided at the Hot Springs meeting June 2-6. Last year it was voted to admit outsiders if there was any space left after members were taken care of.

An exhibit committee was named, consisting of R. R. Englehart, Davenport, Iowa, chairman; N. H. Oliver, Chicago; Fred Campbell, St. Louis; R. A. Stranahan, Toledo; J. S. Proctor, Minneapolis; L. P. Halladay, Streator, Ill.

The name of the Ways and Means Committee was changed to Board of Governors. Discussion of the handling of the revenue tax was left for the Hot Springs meeting.

Industrial Relations Principles

U. S. Chamber of Commerce Takes Up Problem and Lays Down Thirteen Rules

WASHINGTON, April 14—Concrete realization of the new problems that employers must face is brought directly to them by means of a referendum vote on principles of industrial relations requested by the Chamber of Commerce of the United States. The Chamber has prepared a statement of 13 principles, following a study of industrial relations by a special committee. It is placing these 13 principles together with pros and cons before its members.

The conduct of industrial enterprise with regard to both employer and employee, adjustment of industrial relations, employment, organization, representation, wages, production and administration of employment and management of labor form the basis of these principles, which are as follows:

1. Industrial enterprise, as a source of livelihood for both employer and employee, should be so conducted that due consideration is given to the situation of all persons dependent upon it.

2. The public interest requires adjustment of industrial relations by peaceful methods.

3. Regularity and continuity of employment should be sought to the fullest extent possible and constitute a responsibility resting alike upon employers, wage earners, and the public.

4. The right of workers to organize is as clearly recognized as that of any other element or part of the community.

5. Industrial harmony and prosperity will be most effectually promoted by adequate representation of the parties in interest. Existing forms of representation should be carefully studied and availed of in so far as they may be found to have merit and are adaptable to the peculiar conditions in the various industries.

6. Whenever agreements are made with respect to industrial relations they should be faithfully observed.

7. Such agreements should contain provision for prompt and final interpretation in the event of controversy regarding meaning or application.

8. Wages should be adjusted with due regard to the purchasing power of the wage and to the right of every man to an opportunity to earn a living at fair wages, to reasonable hours of work and working conditions, to a decent home, and to the enjoyment of proper social conditions.

9. Fixing of a basic day as a device for increasing compensation is a subterfuge that should be condemned.

10. Efficient production in conjunction with adequate wages is essential to successful industry. Arbitrary restriction on output below reasonable standards is harmful to the interests of wage earners, employers, and the public and should not be permitted. Industry, efficiency and initiative, wherever found, should be encouraged and adequately rewarded, while indolence and indifference should be condemned.

11. Consideration of reduction in wages should not be reached until possibility of reduction of costs in all other directions has been exhausted.

12. Administration of employment and management of labor should be recognized as a distinct and important function of management and accorded its proper responsibility in administrative organization.

13. A system of national employment offices, with due provision for co-operation with existing state and municipal systems, can be made, under efficient management, and if conducted with due regard to the equal interests of employers and employees in its proper administration, a most helpful agency, but only if all appointments are made strictly subject to the Civil Service law and rules. Policies governing the conduct of a national system of employment offices should be determined in conjunction with advisory boards — national, state and local — equally representative of employers and employees.

Picture Range of Heavy Oil Engines for Variety of Uses

Joint Meeting of S. A. E. and Society of Mechanical Engineers Discusses Problems of Design, Including Ignition, Carburetion and Thermal Efficiency

NEW YORK, April 15 — Various phases of the subject of heavy oil engines were illuminated at the joint meeting of the American Society of Mechanical Engineers, New York Branch, and the Society of Automotive Engineers, Metropolitan Section, which was held at the Automobile Club of America on April 9. Dr. Charles E. Lucke of Columbia University was in the chair, and led off with a general discussion of the subject. He said that each of the two societies represented at the meeting was interested in internal combustion engines. This engine is particularly adapted to transportation purposes, on account of the concentration of the liquid fuel, the fact that there is no residue left after the fuel burns, and that the engine lends itself to a great variety of forms, from the light aircraft engine on the one hand to the heavy marine engine on the other. The idea of the meeting was to give a sort of picture of the range involved in the application of heavy oil engines. There were two possible solutions of the problem of internal combustion engines, one being that of adapting the fuel to the engine and the other that of adapting the engine to the fuel. The fuels we are using range very widely in price, from about 30 cents per gallon for gasoline to a few cents per gallon for fuel oil. Then, there are a number of possible fuels which, though not extensively used at present, offer certain possibilities, such as alcohol and benzol. Generally speaking, the lighter the fuel the easier it is to make an engine that will handle it successfully, and vice versa. If we design our engines to consume a fuel of some particular kind the inevitable consequence is that, as the demand for that particular fuel rises, the price increases, and then someone else will make an engine that will burn a different fuel.

Gasoline and Kerosene Costs

In a paper prepared by E. W. Dean of the Bureau of Mines, and read at the meeting by J. S. Smoots, the statement was made that the manufacturing or processing cost is about the same for gasoline and kerosene. The selling cost is largely determined by the proportion betweeen the supply and demand, the cost of manufacture being small. Mr. Smoots exhibited samples of gas oil and of residuum fuel oil, the former being light in color and the latter dark.

Prof. H. Diederichs of Cornell University was to have given a talk on the development of the heavy oil engine, but was unable to be present, and so Prof. Lucke spoke on the subject instead. He said that in the early days of liquid fuel the light constituents of petroleum were a drug on the market. It was a very easy matter to make an engine that would run on these very volatile fuels, all that was necessary being to have a hole in the air pipe through which some of the liquid fuel could be drawn in with the air. As the supply of this volatile constituent decreased a somewhat heavier oil had to be used, and this required a carbureter and heat supply. With the pre-heating of the fuel and air there came a loss in volumetric efficiency. Next, new types of engines were introduced, in which some part of the combustion chamber wall was kept at a high temperature. This was known as the hot surface type of engine, and was developed chiefly in England. The fuel was injected in the form of a spray. Unfortunately this type of engine, in the early days, fouled up very quickly. The great difficulty, however, with the hot bulb or hot surface type of engine was that it was given to pre-ignition. This resulted in a low mean effective pressure. Fuel consumption also was excessive, which was largely due to the fact that the mixture was not homogeneous, some parts of the charge being practically pure air and other parts pure gas.

Injection of the fuel at the end of the compression stroke did away with the difficulty of pre-ignition and permitted of very much higher compression. Late injection, according to Dr. Lucke, is a fundamentally important feature. There are components of crude oil which have a decomposing temperature below their vaporizing temperature. If the spray is very fine, and if it is sufficiently well scattered through the air, then a solid fuel mixture or oil spray mixture will explode, and we can adapt the engine to any fuel we can get. The question then naturally arises, "Can the same sort of engine be developed for heavy work, such as the propulsion of motor ships and for light work such as motor tractors, trucks and automobiles. The speaker did not attempt to answer this question, but intimated that it was one of the problems of the future to adapt the automotive engine to heavier fuels.

Another one of the papers of the evening was by J. M. Hunt, research engineer of the Dayton Engineering Laboratories Co. Mr. Hunt started out by saying that his firm believed in preparedness, and it had looked to them that in a very few years there would not be fuel enough for the automobiles that would then be in use, so they got into the subject to find out what that would do to the ignition problem. The subject of effective ignition could really be divided up under four headings, namely, starting, distribution, vaporization and burning of fuel in the engine, and Mr. Hunt proceeded to discuss these four problems in succession. The problem of starting is not confined to getting a couple of explosions in the cylinder, but getting the cylinder up to its normal temperature. A pre-heater, used to pre-heat the inlet header, would give the desired result, and Mr. Hunt referred to some experiments with the Good pre-heater, which had been described by Dr. Lucke in a paper read before the S. A. E. some two years ago. Another method of solving the problem of starting was to carry two different fuels, a light fuel for starting and a heavy fuel for general running. Problems of distribution are encountered only in multi-cylinder engines. Proper distribution can be attended to after the charge has left the carbureter, and it seems best to incorporate the vaporizing device in the engine itself. The Good pre-heater previously referred to has been extensively tested on a Ford car, fitted with a kerosene carbureter, which has been run 20,000 miles in two years. During this time there has been no mechanical trouble, though it has been necessary to decarbonize the cylinders and to renew the crankcase oil slightly more frequently. The pre-heater has also been tested on a Buick car, which has been run about 12,000 miles to date.

Problems of Vaporization

Vaporization can be discussed under two headings, viz., loss in volumetric efficiency due to heating and the necessity for scrubbing the air against a rough surface. This scrubbing of the air means a further loss in volumetric efficiency, and consequently in the horsepower output.

When it comes to the burning of heavy fuel in an automobile type engine, the most characteristic feature is that the engine is apt to develop a knock. This leads us to the question of what a knock is. It was formerly supposed that a knock was generally due to pre-ignition, but this theory was disproved by experiments at the Dayton Laboratory, and the fact established that knocking is due to a sort of deterioration. Mr. Hunt said that if we want to get rid of crankcase oil pollution, we shall have to raise the temperature of the combustion chamber still higher, and this will further reduce the volumetric efficiency. It will undoubtedly be necessary before long, to devise automotive engines that will operate on gas oil. What is really needed is a sort of priorities board which will tell us just what percentage of all the fuel available, say 5 years hence, can be had for automotive apparatus.

A paper by Mr. Goldingham of the De La Vergne Refrigerating Co., on the heated metal type of heavy oil engine, was read by the chairman. Mr. Goldingham said that this type of engine was often erroneously called a semi-Diesel. Twenty years ago a British manufacturer of internal combustion engines offered a prize to any employee who could produce a heavy oil engine which would run continuously for 10 hours without stoppage. Now it was a common experience to have engines of the heated metal type

operate continuously for six months without stoppage. Great improvements had been made in this type of engine in recent years, which might be summarized briefly under the following headings: (1) More thorough atomization of the fuel, which was injected either by air pressure, or by the solid or mechanical method; (2) improved construction of the vaporizing chamber; (3) force feed oiling; (4) correctly designed air starting mechanism; (5) improvement of the vaporizor lamp.

The rest of the papers of the evening dealt chiefly with the application of heavy oil engines to the wooden ships of the U. S. Emergency Fleet Corporation during the war. Most of the engines used were of the hot-surface type, and it appears that considerable trouble was experienced, which, however, was ascribed to causes not directly connected with the engines. For instance, much green timber was used in the construction of these ships, and the engine bearers often would warp out of place to such an extent that the engine supports would break. Also, it was necessary to get a great many engineers for tending to these engines, and as no experienced men were available, green hands had to be employed.

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National Assn. of Truck Sales Managers to Continue

PHILADELPHIA, April 15—The National Association of Motor Truck Sales Managers will continue as a separate body and devote its energies and attention to the problems of merchandising trucks, as hitherto. This decision was reached at the convention of the association held at the Bellevue-Stratford Hotel on Friday and Saturday, after careful consideration of many proposals and suggestions to do otherwise, and to cast its lot, through affiliations, with other bodies.

It was also decided to appoint a committee to take up the question of organizing an association of truck dealers. The committee will determine whether it will be better to strive for the results which such a dealers' organization would yield through a separate truck dealers' association or through the co-operation of the sales managers' association with the National Automobile Dealers' Association. This committee will report at the next convention, which will be held in Detroit. Future meetings of the association will be purely executive in character. They will be devoted solely to discussion of truck-selling problems.

New members were elected to the association as follows: The Vim Motor Truck Co., Fulton Motor Truck Co., Noble Truck Co., Parker Motor Truck Co., Menominee Motor Truck Co., J. C. Wilson Co., Velie Motors Corp., Canadian Ford Motor Truck Co. and Corbitt Motor Truck Co.

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Reo Returns to Pre-War Hours

LANSING, April 14—The Reo Motor Car Co. will return to its pre-war working schedule April 19, calling for 9 hours a day with half day Saturdays. During the war period it operated on a 10-hr. schedule.

Sees Possibilities in Turbines

Dake Believes They Hold More Promise Than Do Any Reciprocating Engines

CHICAGO, April 12—At the meeting of the Mid-West Section of the S. A. E., yesterday, the possibilities of steam and gas turbines for vehicle propulsion were discussed in a paper presented by Charles W. Dake, chief engineer of the Pyle-National Co., manufacturers of steam turbines for train lighting. Mr. Dake has spent many years in designing turbines of small size and believes that the turbine offers more for the steam-driven vehicle than does the steam engine.

The steam turbine has many features that make it particularly fitted for the propulsion of motor vehicles, said Dake. The turbine will operate perfectly under initial steam pressures and temperatures of superheat far higher than that under which is it possible to operate any other type of fluid motor for the reason that there are no moving surfaces contracting stationary surfaces within the turbine structure, thus taking advantage of the efficiency gained by the use of high pressures and high superheat. Due to the absence of the friction within the turbine, it is not necessary that internal lubrication be provided, and by the elimination of internal lubrication, the exhaust steam is free from oils and greases; consequently the water of the condensed exhaust steam from the turbine can be returned to the steam generator (boiler) without fear of injury thereto.

The turbine, being a high speed machine, requires a system of reduction gearing. This can readily be accomplished with but slight power loss. A pair of properly generated herring bone gears having a reduction ratio of 10 to 1 has a power loss less than 1 per cent.

While the steam turbine can be readily made reversible, due to its high speed and the time required to bring the rotor at rest and start it revolving in a reverse direction, it is advisable to provide gearing for this purpose.

Unlike the reciprocating engine, the efficiency of the steam turbine remains constant throughout its life. This is due to the fact that no packing is required to prevent leakage of high pressure steam and the absence of wear to parts operating under the steam pressures and actions.

The mounting of a turbine rotor in its bearings and the lubrication of the bearings is very much more simple than is possible with either the reciprocating steam or gasoline engine. Ball bearings lend themselves admirably to high speed turbine operation. The size bearings required for a 40-hp. turbine of the type described below can be operated successfully at speeds as high as 60,000 r.p.m. or peripheral velocities of the turbine rotor of approximately 1832 ft. per second.

The steam turbine is commonly thought of as a constant speed and constant load machine, which, in order to obtain high efficiency, should be operated at high velocities and under constant pressure. This is true of most of the present designs of turbines.

However, with proper design and construction, the turbine will give a high efficiency at greatly varying speeds, loads and pressures. This is accomplished by so designing the turbine that the velocity of the steam jets or motive fluid which exceeds the velocity of the rotor shall be entirely absorbed by the rotor's steam passages, and the steam will come to rest in relation to the movement of the rotor at the instant of its exit, regardless of the velocity of the rotor or the velocity of the steam jet.

The dimensions of the rotor, exclusive of the shaft, for a 40-hp. turbine designed to operate under 1500 lb. gage pressure of steam, or rather the velocities derived from that pressure, would be 7 in. in diameter and 4 in. long, and would weigh but 7 lb. The complete turbine, exclusive of external fittings, would weigh less than ¾ lb. per brake horsepower.

The torque delivered to the turbine rotor of the type in mind increases with the decrease in velocity of the rotor, and decreases with the increase of the velocity. In other words, the velocity of the steam jet is absorbed by the rotor regardless of whether it is revolving slowly, or at top speed; therefore, a vehicle propelled by a steam turbine, as above, can be started from rest and will traverse grades at reduced speeds and as well, if not better, than will one propelled by a reciprocating steam engine.

There is at the present time considerable activity among inventors and engineers to produce a turbine that can be operated by the impulse of the explosive combustion of such a mixture as is used in the reciprocating internal combustion engine. This activity, however, seems to be confined to only types and designs of turbines in use at the present time and no effort, it appears, is given to lines of new thought. This, in the writer's opinion, is a mistake, for it is impossible to produce a turbine employing buckets which will withstand the impact of high temperatures such as are delivered by the gasses of combustion.

However, there is under process of development a turbine of great promise designed to overcome many present obstacles, and to provide higher efficiency than is given by the gas engine. Unfortunately, the writer is not at liberty to disclose the details of this machine owing to the conditions of the patent rights both in this country and abroad, which might be jeopardized by so doing. Nevertheless, a brief description of its possibilities and operation will be more in order than its construction.

The flexibility of this turbine is as great as that of the steam turbine, which I have previously referred to. It will operate at any speed from one revolution per minute to the bursting speed of the rotor. The compression of the gas, which is very high—at times reaching 2000 lb. per square inch—is accomplished without mechanical means, and this while the turbine is at rest.

The initial ignition is accomplished by means of a spark from a battery of two dry cells and then continued by means of a hot tube, which, if desired, may be kept hot during stops and for long periods of time. Regardless of weather conditions, the time required to start the turbine is almost instantaneous, and in no case would it be greater than 30 seconds. The turbine can be started from rest, doing away with all starting mechanisms.

The starting torque is greater than that of the reciprocating steam engine of equal power, operating under permissible steam pressures. A 40-hp. turbine complete, including ignition system, gas compression means, controls and shaft coupling, will develop one actual brake horsepower for each 3 lb. of its weight when operated at permissible speeds.

William J. H. Strong of the Strong Engineering Co., Chicago, the other speaker of the evening, presented the plans that were developed for the Government for steam power plants in airplanes. Mr. Strong's company designed for the government aviation officials a steam plant which at 15,000 ft. altitude weighed about 9 or 10 lb. This included engine, boiler, condensing system, auxiliary pumps and the electrical equipment, the horsepower of the plant being 580. The engine operates on the uniflow principle, and in appearance resembles the King-Bugatti. The boiler is a water tube type, having the individual tubes welded into sections and the sections welded to headers.

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$3,199,828 Waste Materials Sold by Army

WASHINGTON, April 11—Waste materials sold by the army during the eight months ending Feb. 9, 1918, totaled $3,199,828, and included:

	Collected, Lb.	Sold, Lb.	Value	Per Cent of Total Amount Collected Sold from June 30, 1918, to Feb. 28, 1919
Non-ferrous metals	4,644,443	4,608,877	$532,536	99
Hides	712	687	149	96
Iron	37,877,434	23,847,772	182,343	63
Leather	2,170,269	277,030	4,877	13
Misc.	6,370,173	16,793,981	403,711	263
Rubber	2,905,527	1,531,029	72,910	53

AUTOMOTIVE MATERIALS MARKETS

Materials Market Prices

Acids:

Muriatic, lb.	.02 - .03
Phosphoric (85%) lb.	.35 - .39
Sulphuric (60%), lb.	.008

Aluminum:

Ingot, lb.	.29 - .31
Sheets (18 gage or more), lb.	.42
Antimony, lb.	.06½- .06⅞

Burlap:

8 oz., yd.	.07
10½ oz., yd.	.09

Copper:

Elec., lb.	.15¼- .15½
Lake, lb.	.15¾- .15⅞

Fabric, Tire (17¼ oz.):

Sea Is., combed, sq. yd.	1.40
Egypt, combed, sq. yd.	1.25
Egypt, carded, sq. yd.	1.20
Peelers, combed, sq. yd.	1.10
Peelers, carded, sq. yd.	.85

Fibre (⅛ in. sheet base), lb. ..... .50

Graphite:

Ceylon, lb.	.09 - .22
Madagascar, lb.	.10 - .15
Mexico, lb.	.03¾

Lead, lb. ..... .04¾- .05

Leather:

Hides, lb.	.25 - .41
Nickel, lb.	.40

Oil:

Gasoline:	
Auto, gal.	.24½
68 to 70 gal.	.30½
Lard:	
Prime City, gal.	2.50
Ex. No. 1, gal.	.95 -1.00
Linseed, gal.	1.45 -1.48
Petroleum (crude):	
Kansas, bbl.	2.25
Pennsy., bbl.	4.00
Menhaden (dark), gal.	.95

Rubber:

Plantation:	
First latex pale crepe, lb.	.49
Brown crepe, thin, clear, lb.	.44
Smoked, ribbed sheets, lb.	.48½

Para:

Up River, fine, lb.	.56
Up River, coarse, lb.	.34
Island, fine, lb.	.47½- .48

Shellac (orange), lb. .60 - .64

Spelter, lb. ..... .06½

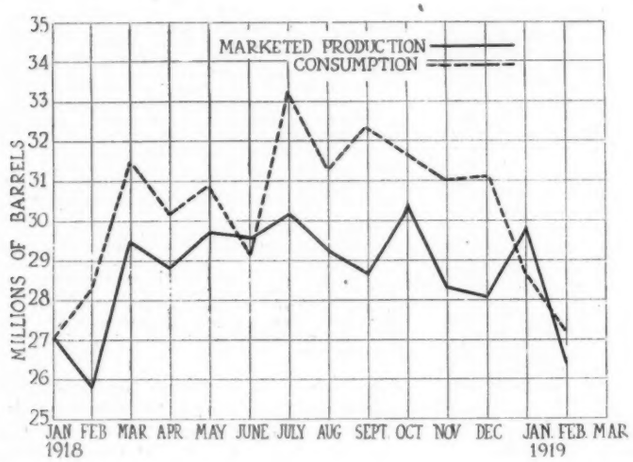
Steel:

Angle beams and channels, lb.	.03
Automobile sheet (see sp. table).	
Cold rolled, lb.	.0625
Hot rolled, lb.	.039

Tin ..... .71 - .72

Tungsten, lb. 1.00

Waste (cotton), lb. .12¾- .17



Estimated monthly fluctuations in marketed production and consumption of crude petroleum in the United States during 1918 *and the first two months of* 1919

AUTOMOBILE SHEET PRICES

(Based on No. 22 Gage. Other gages at usual differentials)

	Primes only per 100 lbs.	Primes when Seconds up to 15 per cent are taken per 100 lbs.
Automobile body stock	$5.95	$5.85
Automobile body stock, deep stamping	6.20	6.10
Automobile body stock, extra deep stamping	6.45	6.35
Hood, flat, fender, door and apron, or splash guard stock	6.05	5.95
Crown fender, cowl and radiator casing, extra deep stamping	6.55	6.45
Crown fender, cowl and radiator casing, deep stamping	6.30	6.20

Automobile Sheet Extras for Extreme Widths:
Nos. 17 and 18 over 36 in. to 44 in., 10c. per 100 lb.
Nos. 19 and 21 over 36 in. to 44 in., 30c. per 100 lb.
Nos. 22 to 24 over 26 in. to 40 in., 40c. per 100 lb.
Nos. 22 to 24 over 40 in. to 44 in., 80c. per 100 lb.

Biank Sheet Extras to Apply to Narrow Widths:
Oiling, 10c. per 100 lb.
Patent leveling, 25c. per 100 lb.
Resquaring, 5 per cent of gage price after quality, finish and size extras have been added.

Seconds 10 per cent less than the invoice Pittsburgh price for corresponding primes.

Automotive Securities on the Chicago Exchange at Close, April 12

	Bid	Asked	Net Ch'ge
Auto Body Company	9	10	..
Briscoe Motor Car com.	13	..	..
Briscoe Motor Car pfd.	50	65	..
*Chandler Motor Car	140	142	+14
Chevrolet Motor Car	199	201	+10
Cole Motor Car Co.	93	105	..
Continental Motors com.	7¾	8¼	..
*Continental Motors pfd.	96	99	—2
Edmunds & Jones com.	15	20	..
Edmunds & Jones pfd.	75	90	..
Electric Storage Bat.	69	71	..
Federal Motor Truck	34	36	..
Fisher Body Co. com.	58	60	+2
Fisher Body Co. pfd.	92	94	..
Ford Motor of Canada	285	295	..
General Motors com	175¾	176¾	+5¼
General Motors pfd.	91⅛	93⅛	+1⅜
Hupp Motor Car com.	8¼	8¾	+½
Hupp Motor Car pfd.	96	99	..
Kelsey Wheel Co. com.	35	37	..
Kelsey Wheel Co. pfd.	93	95	..
Manhattan Electric S. com.	..	48	..
Maxwell Motor com.	38⅝	39⅝	+1⅞
Maxwell Motor 1st pfd.	67¼	68¼	+2¼
Maxwell Motor 2nd pfd.	30¼	31¼	—¼
McCord Mfg. com.	33	36	+1
McCord Mfg. pfd.	91	95	..
Mitchell Motor Co.	27	31	..

	Bid	Asked	Net Ch'ge
Motor Products Corp.	..	35	..
Nash Motors Co. com.	230	250	..
Nash Motors Co. pfd.	95	100	..
National Motor Co.	15	20	..
Packard Motor Car com.	122	125	+2
Packard Motor Car pfd.	99	101	..
Paige-Detroit Motor com.	28½	29½	..
Paige-Detroit Motor pfd.	8¾	9¾	..
Peerless Motor Truck	21	23	..
Pierce-Arrow M. Car com.	49½	50½	+3¾
Pierce-Arrow M. Car pfd.	102	104	..
Premier Motor Corp. com.	5	..	..
Premier Motor Corp. pfd.	..	75	..
Prudden Wheel Company	18	19	..
Reo Motor Car Co.	23¾	24½	+¼
Republic M. Truck com.	39½	41½	..
Republic M. Truck pfd.	91	95	..
Saxon Motor Car com.	6⅝	8⅝	+⅛
Scripps-Booth Corp.	21	25	..
Stewart Warner S. Corp.	91	93	+1½
Stromberg Carburetor Co.	38	40	..
Studebaker Corp. com.	65⅝	66⅜	+1¼
Studebaker Corp. pfd.	94	97	..
*Stutz Motor Car Co.	56	57	+5⅜
United Motors Corp.	45⅝	47⅝	+⅝
White Motor Co.	55⅝	56⅝	+1⅜
Willys-Overland com.	29½	30½	+⅞
Willys-Overland pfd.	92	93	..

RUBBER STOCKS

	Bid	Asked	Net Ch'ge
Ajax Rubber Co.	78¾	79¾	+4¼
Firestone T. & R. com.	144	148	—3
Firestone T. & R. pfd.	100	102	—1
Fisk Rubber Co. com.	137	142	+29
Fisk Rubber 1st pfd.	100	105	..
Fisk Rubber 2nd pfd.	137	142	+30
Fisk Rubber 1st pfd. conv.	105	110	+6
Goodrich, B. F., com.	66½	67½	+1¼
Goodrich, B. F., pfd.	106½	107½	..
Goodyear T. & R. com.	270	275	..
Goodyear T. & R. 1st pfd.	105½	107	..
Goodyear T. & R. 2nd pfd.	107	108½	+½
Kelly Springfield com.	126	127	+7½
Kelly Springfield 1 pfd.	95	97	..
Lee Tire & Rubber Co.	27	28	+2
Marathon Tire & Rubber.	55	75	+3
Miller Rubber Co. com.	170	175	—5
Miller Rubber Co. pfd.	102	104	..
Rubber Products Co.	125	130	—4
Portage Rubber Co. com.	158	162	..
Swinehart T. & R. Co.	77	81	—3
U. S. Rubber Co. com.	86½	87½	+3
*U. S. Rubber Co. pfd.	111⅞	112⅞	+⅝

*Ex dividend.

British Westinghouse Control to Vickers

Through Absorption of Metropolitan Carriage Company in Deal Involving $132,500,000

LONDON, April 1—One of the biggest business deals in which British interests have figured for some time is the absorption by what is known as the Vickers interests of the Metropolitan Carriage & Wagon Co. The event here referred to is not of interest to the motor trade in itself, but the latter company recently acquired a controlling interest in the British Westinghouse Co., Manchester. This company, aiming at a variety of output, is interested in the British replica of the Pittsburgh company's dynamo and starter for vehicles.

This new step by the Vickers Co. through a subsidiary company in their own group, concerned with the B.L.I.C. (late Bosch) magneto, dynamo and starter, is likely to involve the cessation of the corresponding Westinghouse lines. Otherwise there would be virtual competition between these rival wares.

The B.L.I.C. manufacturing side is being transferred from London to a factory in Birmingham, until recently used by the Electric & Ordnance Accessories Co. Up to this time this company has built the Wolseley Co.'s Stellite car, the complete manufacture of which, however, is being arranged for in the Wolseley Co.'s now much extended factory.

The amalgamation or absorption of the Metropolitan Carriage company's business involves a capital of $132,500,000, which will give some idea of the vast financial resources of the Vickers group. Many people read into this expansion of the Vickers interests the intention to be prepared for quitting armaments manufacture, if necessary, in favor of a wholesale concentration on peace industries. By the way, it is reported that the Wolseley and Vickers interests have arranged an alliance with a Japanese engineering company, who will build Wolseley cars for its Far East territories.

—

New English Insurance Company Emphasizes Service

LONDON, April 1—The Motor Union Insurance Co., one of the leading insurance organizations in writing motor car insurance, has entered the garage and repairshop field. This move comes as retaliation to the Motor Trade Association, which some years ago formed an insurance company as an independent venture for the benefit of its members as well as for the revenue obtained. As the membership of the M. T. A. is large and increasing, the move of this new insurance company means that the number of garages and repairshops will increase.

The insurance company has chosen the subject of service as one of the requirements of its garages and repairshops. Hitherto service has been a sort of counsel of perfection, but the Motor Union Insurance Co.'s scheme makes it obligatory, and also imposes the condition that the garages favored with its patronage shall conform to its standard of equipment and facilities for repairing, etc.

The alternative to these conditions will be for the local dealer to send his work to one of the Union's pivotal depots, as they are to be called, and he will be allowed a trade abatement at a fixed rate or per cent off the price levied on private customers.

Each pivotal depot will be a center for an associated group of repairers and dealers, approved by the Union Insurance Co., which seems to imply that membership of the M. T. A. will be a ban on membership in the new company's pivotal scheme.

Public and private motorists will be the gainers by the proposed competition, much of it centering in the quality of service benefits of the competing parties. Hitherto there can be no gainsaying the fact that the M. T. A. has been regarded by ordinary motorists as being more concerned in pushing up and maintaining prices than in securing a common standard of high grade service. The new issue seems a favorable opportunity to set this matter right.

—

English Truck Company Adds 6-Cylinder Car

LONDON, April 1—The Straker-Squire Co., manufacturer of the Straker-Squire truck, has purchased one of the Government war factories and plans to concentrate on the manufacture of a 6-cylinder car in addition to one or more sizes of trucks.

The new Straker-Squire "six" with cylinders 80 x 130 has them as separate castings. The reason for reverting to the separate cylinder as compared to the block type is that there is not so much danger of hot spots developing in the individual cylinder as in the block type due to difficulties incidental to misplaced cores and the irregular flow of metal in the block. The car has dial on the dash showing the speed of crankshaft rotation and the speedometer is driven from the gear-box.

The factory purchased occupies 14 acres and was bought at $700,000, which is more than the original cost of construction and equipment by the Government. Formerly the Straker-Squire Co. had a factory at Bristol which was recently sold to the Cosmos Engineering Co., Ltd., which concern at that time had interests in the 6-cylinder car and in reality developed it. The Cosmos company entirely disposed of its interests and is now developing a new car employing a radial engine which also carries several other earmarks of airplane development. Roy Fedden, who designed the Straker-Squire 6-cylinder car, remains with the Cosmos Company.

—

Aluminum Castings Operations

MILWAUKEE, April 12—The Aluminum Castings Co., Cleveland, probably will discontinue its Manitowoc plant on May 1 and divide the operation between its works at Cleveland and Detroit.

No Guarantee for English Tires

Solid Tires to Be Judged by Performance, Not Guarantee, Is Reason for Decision

LONDON, April 1—The abandonment of a guarantee on solid rubber tires by the British tire makers has naturally aroused a good deal of criticism, and many business organizations do not know just why this step was taken. The guarantee of 10,000 miles on these tires had its origin in the early days of the motor truck when tire costs were about as fluctuating as the mileage was varied. At that period, too, the initial cost of a set of truck tires was a much more serious item than latterly, being often sufficient, in the event of a premature collapse of two or more of a set, to preclude the vehicle concerned from showing a profit on a year's turnover. It is now frequently the experience of users that a set of tires go far beyond the mileage guaranteed.

Reasons assigned for the decision to withdraw the guarantee of mileage are:

That it leads users to expect the guaranteed mileage and nothing more; that it tends towards the production of a stereotyped tire, just capable of fulfilling the guarantee and no more; encourages carelessness on the part of the driver, who regards the responsibility for the tire as solely that of the maker; and that it is necessarily hedged about by technical conditions and stipulations, which in some circumstances are difficult to see.

The British Rubber Tire Manufacturers' Association for the future will be content to allow their products to be judged by the service given as distinct from merely guaranteed.

Considerable assistance in regard to these points is expected from systematic collective research and the British Rubber & Tire Manufacturers' Research Association, which is now in process of formation.

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Twin City 12-20 Kerosene Tractor

(*Continued from page* 839)

worm and sector type of steering gear of generous proportions is mounted on the right-hand side of the transmission case, and runs in oil. The size of the steering wheels, and a liberal gear reduction, coupled with the light weight of the tractor and the weight distribution, make it a very easy machine to handle in the field. Stops are provided on the front wheel tie rod to limit the maximum turning angle of the front wheels.

The belt pulley is 16 in. in diameter and has a 6-in. face. It is mounted on the left-hand end of the first countershaft, and is removable. The linear belt speed is 2700 ft. per minute.

The front end of the tractor is supported through coil springs upon a drop-forged steel front axle of I section, with reversed Lemoine steering heads. This axle swings vertically on a center pivot. The front wheels have rolled-steel flanged rim 34 in. in diameter and 6 in. wide. The wheelbase is 84 in., and the weight of the tractor stripped is 4000 lb.

Field tests have proved that a load of 35 per cent in excess of the rating can be easily sustained, and the engine when running at its governed speed of 1000 r.p.m. will develop a maximum of 35 b.hp. on kerosene.

Dawson to Manage Gary Truck

GARY, IND., April 12—A number of important additions have been made to the personnel of the Gary Motor Truck Co., although the officers remain unchanged. Frank Dawson has been appointed general manager of the company. He was formerly factory manager of the Randolph Motor Truck Co., Chicago; was later with the Mogul Truck Co., St. Louis, and in 1916 was appointed factory manager for the Master Truck Co. E. Von Rakowski has been appointed chief engineer, and has been closely associated with Dawson for several years past. Theodore B. W. Zumstein has entered the sales department. The Gary company has just closed a contract with the Cooper Motor Co., Kansas City, with branches in Omaha, Tulsa and other western and southwestern cities for more than a million dollars' worth of Gary trucks, to be delivered within the next 12 months. The company will operate as a factory branch and will have exclusive sales of Gary trucks in Missouri, Arkansas, Oklahoma, western Iowa, Nebraska and South Dakota.

—

Frank W. Haskell, president of the Carborundum Co., Niagara Falls, N. Y., died April 2 at Daytona, Fla. His death was due to heart failure.

—

J. G. Lude, for six years purchasing agent of the Falls Motors Corp., Sheboygan Falls, Wis., has resigned to become assistant general manager of the Lewis Steel Products Co., Toledo. Angelo R. Clas, formerly secretary-treasurer of the Falls company, has been president and general manager of the Lewis company since Jan. 1.

—

C. H. Margell, formerly assistant general manager of the Monarch Governor Co., Detroit, has become associated with LeRoi Co., maker of car and tractor engines, Milwaukee, as assistant chief inspector.

—

G. H. Hamilton, Milwaukee, has been appointed manager of the new export department of the Federal Rubber Co., Cudahy, Wis., which has been established, with headquarters at the Federal company's eastern headquarters, 38 and 40 West Sixty-second Street, New York City. The export business heretofore was handled through the general offices at Cudahy.

—

R. T. West has been appointed sales manager for the Hession Tiller & Tractor Corp., manufacturer of the Wheat tractor.

—

Duplex Adds Sales Engineers to Staff

BROOKLYN, N. Y., April 11—V. N. Barton has been added to the sales engineering department of the Duplex Engine Governor Co., and will cover Pennsylvania and the southern states. R. Weston Doherty has a similar position covering New York, New Jersey and New England territories.

Men of the Industry

Changes in Personnel and Position

Clyde Export Representative on Business Tour

NEW YORK, April 11—In order to keep more closely in touch with their foreign dealers and conditions in the Far East, P. W. Gaylor has left on a trip through that territory for the Clyde Cars Co. He will visit China, Japan, Siam, the Federated Malay States, Straits Settlements, Dutch East Indies, India, etc.

—

Horning to Speak at Detroit

DETROIT, April 12—At the April 25 meeting of the Detroit Section of the Society of Automotive Engineers H. L. Horning, chief engineer and general manager of the Waukesha Engine Co., Waukesha, Wis., will deliver a talk entitled "Tractor Engines." The meeting will be held in the ballroom of the Hotel Pontchartrain.

—

John A. Glaspy, who has been manager of the Kelly-Springfield Tire Co. at its Milwaukee branch, has resigned to become assistant general sales manager of the International India Rubber Corp., South Bend.

—

C. W. Whitston, until recently sales manager of the Panhard Motor Truck Co. of Grand Haven, Mich., has been made district sales manager for the Nelson Motor Truck Co., Saginaw. He will handle the Southwest territory, with headquarters in Los Angeles, Cal.

—

J. F. Fernihough, formerly district representative for the Bethlehem Motor Truck Co. in the Middle West, will be in charge of the Northwest territory sales of the Nelson Motor Truck Co. Chicago will be his headquarters.

—

Raymond A. Long, chief engineer of the Columbia Motors Co., who for two years was engaged in Government work, assisting in designing the Militor truck, has returned to Detroit and resumed his duties with the Columbia company.

—

C. K. Sincebaugh has severed his connection as sales engineer with the tractor equipment division of the Remy Electric Co., and is associated with the Rex Machine Co., Chicago, as general manager.

—

H. H. Burger has taken charge of the Stewart Products Co., Cleveland, as manager. This company, which has been operated as a Stewart-Warner factory branch, has been changed to a service station.

National Designer Is Back

INDIANAPOLIS, IND., April 12—Lieut.-Col. William Guy Wall has returned to assume his connection as vice-president and chief engineer of the National Motor Car & Vehicle Corp. He has been chief engineer of the National factory for 15 years. He headed that section of the ordnance department charged with design, construction and maintenance of armored cars, tanks, ammunition trucks and artillery tractors.

—

Allen of Austin Co. Returns to England

NEW YORK, April 15—C. H. Allen, manager of the sheet metal department of the Austin Co., Birmingham, England, and who has been in this country for several weeks purchasing presses for body manufacturers in production quantities, returned to England this week. Mr. Allen has been in sheet metal work for 20 years and has been making a complete study of the different American plants in addition to having ordered 7 special presses for body production work. These are to be used in connection with the production work of Austin Model 20, one of the British war cars.

—

Pogue Now With Division of Mineral Technology

WASHINGTON, D. C., April 12—Joseph E. Pogue, formerly connected with the Bureau of Oil Conservation, which has recently ceased activities, is now connected with the Division of Mineral Technology in the United States National Museum. This division is carrying on educational work with special reference to the mineral industry. Mr. Pogue, while with the Bureau of Oil Conservation, gave much attention to the question of possible supply of crude oil.

—

Edge to Re-enter British Industry

LONDON, April 1—S. F. Edge, one of the best known figures in the British motor industry, until his withdrawal 7 years ago from the Napier organization, is expected to return to the industry now that his 7 years' contract to refrain from enterprise in the motor trade has expired. He is expected to take up the manufacture of a fully equipped car that will list at $1500.

—

C. F. Rouze, formerly sales manager for the Knox-Martin Tractor Co., has been placed in charge of the sales promotion department of the General Motors Truck Co., Pontiac.

—

Charles Kuehn, who has been with the Packard advertising department for a number of years, has been put in charge of advertising and sales promotion department of the Packard Detroit branch.

—

K. W. Macrae, for the past 5 years in charge of the Canadian sales for the Saxon Motor Car Corp., has tendered his resignation, to take effect at once.

Chalkis Will Make Lock Washers

DETROIT, April 12—The Chalkis Manufacturing Co., organized during the war by Hugh Chalmers and W. C. Kiser to manufacture guns for the Government, and whose war operations were brought to a sudden halt before they were well started by the signing of the armistice, will shortly enter the automotive parts field. The company will start the production of lock washers within 30 days, and later other lines will be added.

The present Chalkis plant on Mack Avenue has been sold. Nearly $500,000 worth of machinery designed for munition work will revert to the Government. The Detroit Culto-Tractor Co. first proposed locating in the Chalkis plant, but this plan was abandoned some time ago.

The Chalkis Co. will move into the down-town district, having leased the sixth and seventh floors of a new Power building. At a recent election of officers Hugh Chalmers was elected president; W. C. Kiser, vice-president and general manager, and A. W. Lott, secretary and treasurer. Mr. Lott comes to the Chalkis company from the office of A. W. Wallace Co., brokers.

—

International Rubber to Increase Output 200 Per Cent

SOUTH BEND, IND., April 12—G. W. Odell was elected president and treasurer of the International India Rubber Corp. at a meeting of the board of directors, and he will also continue the general management of the company. Other officers are: Vice-president, Peter E. Studebaker; secretary, J. A. Bennett. The officers and C. W. Truxell and J. W. Ridge form the board of directors.

It was decided at the meeting to go ahead with the plans made last year to extend the length of the main building to 967 ft. This extension with additional equipment will increase the output of the plant about 200 per cent.

—

Arrow Grip Capital Increased to $500,000

GLENS FALLS, N. Y., April 12—The Arrow Grip Mfg. Co., Inc., has increased its capital from $100,000 to $500,000, and is at present erecting a new factory here.

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Aluminum Goods Spending $1,250,000 on Plant Additions

MANITOWOC, WIS., April 14—The Aluminum Goods Mfg. Co., with branch factories in Two Rivers, Wis., and Newark, N. J., will this year invest approximately $1,250,000 in the enlargement of the Two Rivers and Manitowoc plants. Contracts have been awarded for three new buildings at Two Rivers, and another contract will be awarded for a 5-story addition, 160 x 280 ft., here during the coming week. The Two Rivers buildings are: Plant No. 1, 50 x 320 ft., 3 stories; plant No. 4, 60 x 300 ft., 4 stories; warehouse, 44 x 137 ft., 3 stories. The present works here and at Two Rivers each employs more than 1500 operatives.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

Japanese Truck Manufacturer Organized

DETROIT, April 11—A Japanese company is being organized to manufacture motor trucks in that country. Through Gaston, Williams & Wigmore, New York City, this company is placing orders with Detroit automotive firms for parts for several experimental trucks which it proposes to assemble at once. The company, with $2,500,000 capital, is buying engines, transmissions, steering gears, wheels, clutches and other parts. Cutting, Armistrong & Smith and the Grey Motor Co. of this city have received preliminary orders for this material and are preparing shipments for New York.

—

Swedish Company Enlarges Plant

WASHINGTON, April 11—The Scania Vabis Works, Malmo, Sweden, have completed additions to their factory enabling them to manufacture complete automobiles. This company, which manufactures gas engines and electric motors, turned out a production in 1917 valued at $1,622,000.

—

G. M. Absorbs Michigan Crankshaft

LANSING, April 12—The Michigan Crankshaft Co. is the latest organization to be added to the General Motors holdings. By this deal the National Engineering Co., Saginaw, which was owned by the Michigan Crankshaft Co., automatically becomes General Motors property. Much of the grinding work of Lansing General Motors companies will be handled in the new plant.

The Michigan Crankshaft Co. was organized ten years ago with a capitalization of $50,000. This was later increased to $200,000. With the additional capital it bought the National Engineering Co. at Saginaw. J. W. Wilford will remain at the head of the company, and will continue the management of both Lansing and Saginaw plants.

—

Branch of General Asbestos Moved

CHICAGO, April 12—The Chicago branch of the General Asbestos & Rubber Co. has been moved into new and larger quarters at 14 North Franklin Street.

—

Porter-Cable Buys Lathe Company

SYRACUSE, April 12—The Porter-Cable Machine Co. has purchased the business of the Mulliner-Enlund Tool Co. and will move the latter company's equipment to the Porter-Cable plant. The production of Mulliner lathes will be continued. Both Mulliner and Enlund will be connected with the Porter-Cable organization.

Moon Victory Model in Production

ST. LOUIS, April 14—The Moon Motor Car Co. is now in production on its new Victory model, which is to sell at $1,685, and which was first exhibited at the St. Louis show. It is a 5-passenger, 118-in. wheelbase car, equipped with a 3¼ x 4 6-cylinder Continental engine.

—

New Jumbo Model

SAGINAW, MICH., April 11—The Nelson Motor Truck Co. is getting into production on a new 2-ton tractor. The tractor has a 108-in. wheelbase. All specifications are the same as the regular Jumbo truck. The tractor will be marketed in connection with 3 to 5 and 5 to 7-ton semi-trailers as a 6-wheel unit for heavy-duty work.

This company also proposes to bring out a new 3½-ton truck in about 90 days. The new truck will have a T-V Buda engine, Clark axles, four-speed transmission, unit power plant with drive torque rods and a pressed-steel frame. The manufacture of the regular 2-ton model will be continued.

—

New 1½-Ton Selden Ready for Delivery

ROCHESTER, April 14—The Selden Truck Sales Co. will commence deliveries of its new 1½-ton worm-drive model on April 21. It is equipped with a 3¾ x 5 Continental Red Seal engine with high tension magneto and Stromberg carbureter. It will sell for $2,185. Tires are 34 x 3½ single, front, and 34 x 5 single, rear. Pneumatic equipment is extra. The wheelbase is 140 in. and the length of the loading space 9 ft. 6 in.

—

Shipping Board to Use Wisconsin Engine Plant

RACINE, WIS., April 14—A lease taken by the United States Shipping Board, Emergency Fleet Corp., of the plant of the defunct Wisconsin Engine Co. at Corliss, will not affect the possession held by the Corliss Motor Truck Co. of one of the group of buildings which it uses as a factory. The Shipping Board will use the plant for assembling, storage and shipping vessel parts, machinery and equipment. The lease is for 5 years.

—

National Tractor Now GO

CEDAR RAPIDS, April 14—The National Tractor Co. has changed the name of its product from National to GO, and is bringing out a new machine similar to its older model but equipped with a Waukesha 4½ x 5¾ engine.

—

D. & L. Will Make Mechanical Appliances

MILWAUKEE, WIS., April 14—The D. & L. Mfg. Co. has been organized at Milwaukee with an authorized capital stock of $50,000 to manufacture tools, dies, fixtures and general mechanical appliances. The incorporators are Henry C. Dorn and Herman L. Luedke.

Calendar

SHOWS

April 16-19 — Waynesburg, Pa. Automobile Dealers' Assn. of Greene Co., Armory. Frank L. Hoover, Mgr.

May 10-17—Bristol, Va.-Tenn. Cars, Trucks, Tractors, Airplanes and Accessories. Bristol Chamber of Commerce. C. W. Roberts, Manager.

May 15-June 1—Venezuela. National Exhibit of Venezuela.

June 2-6—Hot Springs, Va. Convention, Automotive Equipment Assn., Homestead Hotel.

*Oct. 15—Paris. Grand Palais, International Automobile Mfrs. Congress.

Nov. 7-15 — London. Olympia Motor Car Exhibition—Society of Motor Mfrs. and Trades.

December—Brussels. International Automobile Mfrs. Congress.

January—New York. International Automobile Mfrs. Congress.

February — Chicago. International Automobile Mfrs. Congress.

Feb. 23-Mar. 6 — Birmingham, Eng. British Industries Fair.

TRACTOR SHOWS

April 23 - 25 — Walla Walla, Wash. Sectional Tractor Demonstrations.

May 5—Sacramento, Cal. Sectional Tractor Demonstrations, Demonstration Field.

June — Denver, Col. Sectional Tractor Demonstrations.

July—Wichita, Kan., Automotive Committee of National Implement Assn.

Aug. 18—Aberdeen, S. D. Sectional Tractor Demonstrations.

RACES

April 24—San Bernardino, Cal. Rim of the World Hill Climb.

†May 17—Uniontown, Pa., probably 112½ miles.

†May 31—Indianapolis, Indianapolis Motor Speedway Assn., 500 miles.

*June 14—Sheepshead Bay, L. I. Speedway race.

*July 5—Cincinnati, O., Speedway.

*July 19—Uniontown, Pa. Speedway race.

*July 26—Sheepshead Bay, L. I. Speedway race.

*Aug. 15—Middletown, N. Y. Dirt track event.

*Aug. 22-23—Elgin, Ill. Road race.

*Aug. 23—Sheepshead Bay, L. I. Speedway race.

*Sept. 1—Uniontown, Pa. Speedway race.

*Sept. 20—Sheepshead Bay, L. I. Speedway race.

*Sept. 27—Allentown, Pa. Dirt track event.

*Oct. 1—Cincinnati, O. Speedway race.

*Oct. 4—Trenton, N. J. Dirt track event.

*Oct. 11—Danbury, Conn. Dirt track event.

†Sanctioned.
*Tentative dates.

CONVENTIONS

April 24-26—Chicago — National Foreign Trade Council. Sixth National Foreign Trade Convention. Congress Hotel.

April 28-May 1—St. Louis, Mo. Chamber of Commerce of United States Convention.

May 1-June 1 — Atlantic City, N. J.—Pan-American Aeronautic Convention and Exhibition — Aero Club of America, the Aerial League of America and the Pan-American Aeronautic Federation.

May—Washington, Pan-American Commercial Conference, Pan-American Union Building.

June 23-28—S. A. E. Mid-summer Meeting.

Sept. 22-24—Philadelphia, Annual Convention, National Association of Purchasing Agents, Bellevue-Stratford.

Allen Motor Co. to Boost Production

COLUMBUS, OHIO, April 14.—The Allen Motor Co., of Fostoria and Bucyrus, Ohio, will move to Columbus. It is a $3,000,000 concern with five plants in operation for six years. Its record output is 5000 cars made in 1916 and its pay-roll aggregates $1,000,000 annually. The company hopes to boost its production to 20,000 after it is located in its new Columbus plants.

The factories formerly occupied by the Columbus Buggy Co., will be occupied by the Allen Co. The Scioto Rubber Co. is to be absorbed in the deal. The Allen Motor Co. is at present employing 500 men.

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Fordson Dealers Get More

DES MOINES, April 15—The price of the Fordson in Iowa, Nebraska and South Dakota, the territory of the Herring Motor Co., has been advanced to $926, f.o.b. Dearborn, Mich., plus handling charges. The dealer price remains as before, giving the dealer about $40 additional in lieu of an increase in the discount. The increase makes the discount from 15 to 17 per cent.

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Kelsey Wheel Addition

WINDSOR, ONT., April 12—A building permit has been granted to the Kelsey Wheel Co. for the erection of an addition to the plant.

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Haynes to Have Capacity for 50 a Day

KOKOMO, IND., April 12—Work is to be begun immediately by the Haynes Automobile Co. on the erection of a building 150 x 500 ft., 4 stories high, and of a new forge shop, 70 x 180, following the recent increase of its capital from $3,500,000 to $5,000,000 through the issue of $1,500,000 preferred stock at 7 per cent. Other improvements in the plant are to be made, and when all the work is completed in the fall the normal capacity of the plant will be increased to about 50 cars a day.

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General Motors Truck Co. Finishes War Work

PONTIAC, April 14—The General Motors Truck Co. finished its war work in January, when 500 trucks were turned over to the Government, and is now getting fair production for commercial sales. An average of 30 machines is being turned out daily, but plans call for a material increase in production during May and June. This company, having extended its manufacturing facilities last year, does not come in for a split of the General Motors expansion budget.

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Maxwell to Retire $145,244

NEW YORK, April 15—The Maxwell Motor Co. is shortly to retire $145,244 of its first preferred stock. This amount is now held by the Central Union Trust Co. of New York as trustee for the company. On May 16 the trust company will receive bids for the retirement of not to exceed 2880 shares of stock.

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Eagle Officers Changed

APPLETON, WIS., April 14—Frank Saiberlich, president and founder of the Eagle Mfg. Co., maker of farm tractors, gas engines, etc., has disposed of his interest and will retire. His brother, Oscar, also has sold his third interest, but Edward Saiberlich, secretary and treasurer, remains a stockholder and officer. The new interests are represented by August Knueppel, Nicholas Dohr and Matt Rossmeissl, all of whom are large stockholders in the George Walters Brewing Co.

Dorr-Miller Differential Acquires Tool Company

NEW YORK, April 12—The Dorr-Miller Differential Co. has purchased the interests and plant of the Ward Machine & Tool Co., Detroit, and will correspondingly increase its manufacturing facilities. A part of the plant will be devoted entirely to the special differential for Fords. This type is to be distributed through county agents who are now being appointed.

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Columbia to Double Production

DETROIT, April 12—The Columbia Motors Co., while working on plans for a new factory plant, will not build this year but will lease buildings providing sufficient facilities to permit the company to double its production. Extension plans for doubling its floor space would add 100,000 sq. ft. It has orders for 1300 cars and contemplates producing 3000 passenger cars this year.

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Maxwell Completes Last Tractor

DETROIT, April 11—The last military tractor was completed by the Maxwell Motor Co. last week, and the company is getting back into full peace production of cars. The machine finished last week was No. 2000, and was a 5-ton model. The original contract called for 3000 tractors, but the early termination of the war cut this number by one-third. This company has already run its passenger car production up to 220 daily.

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New Torbensen Axle Officials

CLEVELAND, April 12—J. O. Eaton was elected president, with two vice-presidents, W. J. Baxter and C. F. Hepburn, at the directors' meeting of the Torbensen Axle Co. Other officers are: Chairman of the board, V. V. Torbensen; treasurer, F. A. Buchda; secretary, A. H. Ide; assistant secretary, R. C. Hyatt, and comptroller, M. M. Risberg.